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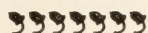
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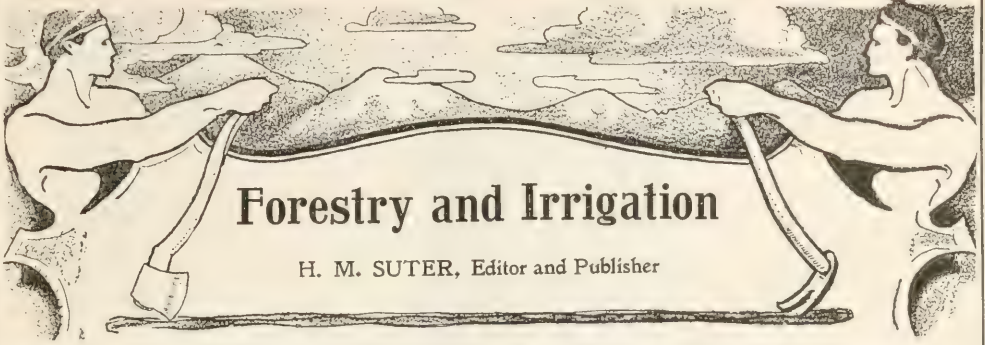
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Forestry and Irrigation

H. M. SUTER, Editor and Publisher

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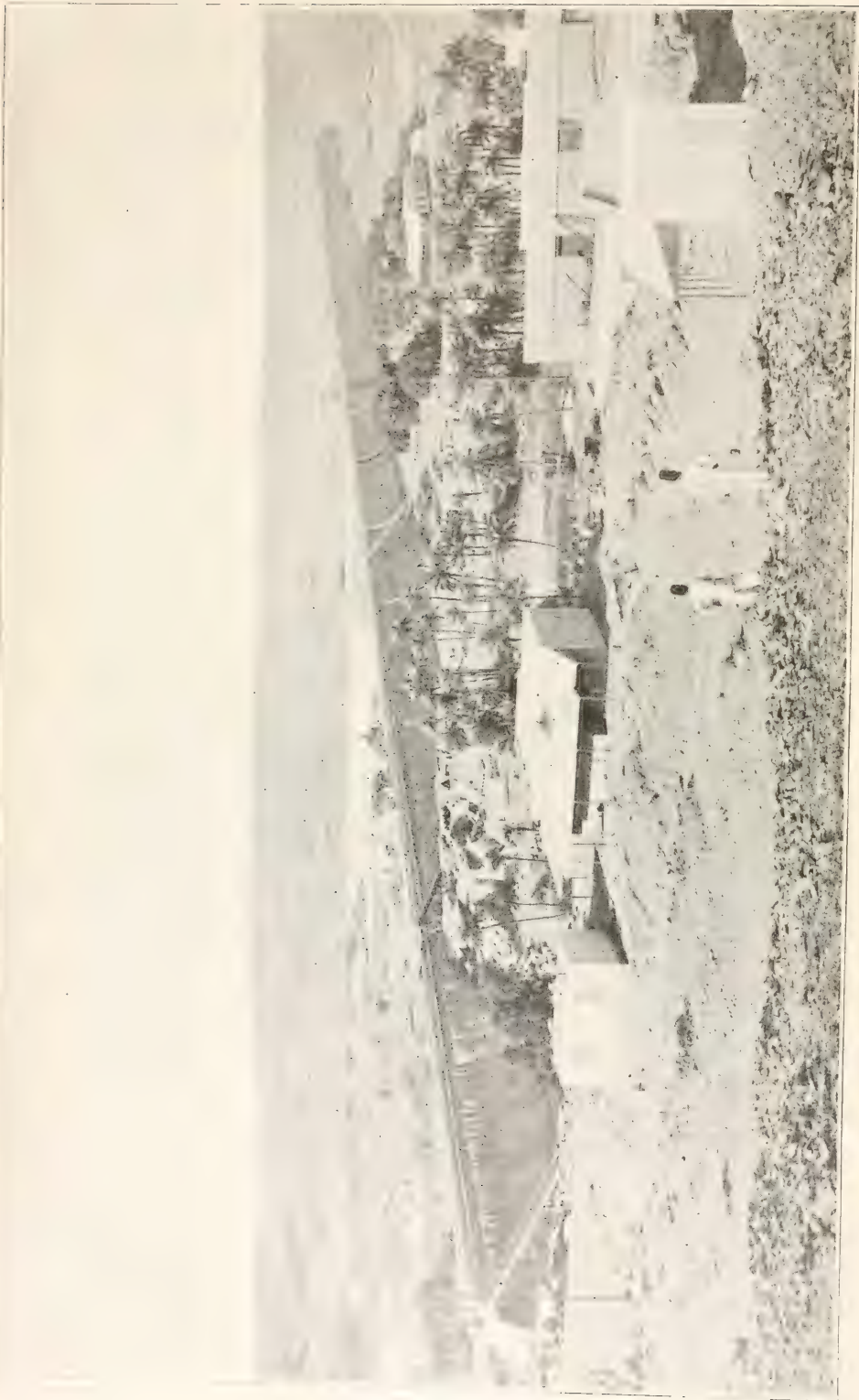
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Forestry and Irrigation.

VOL. X.

JANUARY, 1904.

No. 1.

NEWS AND NOTES.

Public Land Commission.

The commission appointed by President Roosevelt, consisting of Commissioner Richards, of the General Land Office; Gifford Pinchot, Forester of the Department of Agriculture, and Frederick Haynes Newell, Chief Engineer of the Reclamation Service, as announced in this column last month, to inquire into the public-land affairs and prepare definite information on the subject for the use of Congress, has been holding daily meetings at the General Land Office, in Washington. The commission, in its endeavors to collect all possible useful information, is calling upon all persons who have reason to be familiar with existing conditions. A number of members of Congress have already appeared before the commission to testify, among these being Senator Newlands of Nevada, Senator Dubois of Idaho, and Senator Fulton of Oregon; also Representatives Lacey of Iowa, Mondell of Wyoming, Jones of Washington, and Martin of South Dakota. They have been asked to give facts concerning the administration of the public lands under the existing laws and suggestions for future handling.

Mr. Pinchot and Mr. Newell have been ordered by the President to attend the conventions of the National Live Stock Association and the National Wool Growers' Association, which are to be held simultaneously at Portland, Oregon, January 11-15, in order to learn the sentiment of the grazing interests toward the public-land question. Mr. Pinchot will at the same time state the administration's policy on forest reserve matters.

The early activity of the Public Land Commission bears out the prediction

made in this column last month in commenting upon its make-up: that its members were chosen wholly because of their intimate knowledge of the questions involved, which would result in a completed investigation in much shorter time than is true of the deliberations of most commissions. There is every reason to expect that its findings will be laid before Congress at an early day.



Fire at Yale Forest School.

At about 2 a. m., December 11, Marsh Hall, in which the work of the Yale Forest School is carried on, was seriously damaged by a fire which started in the basement and spread through practically all of the four stories, destroying the interior woodwork and furnishings and involving, to a greater or less extent, the library, collections, and other equipment.

The collections of South American woods and of western conifers were totally destroyed, as was also a large part of the tools and forest implements.

The large collection of domestic woods was badly smoked, but otherwise uninjured.

The microscopes and other equipment of the Botanical Laboratory were slightly damaged. The valuable library fortunately escaped with little injury.

One of the heaviest losses was in the Technological Laboratory, where nearly the entire data for six months' work by an expert and two assistants was destroyed, with the apparatus. This was coöperative work with the Bureau of Forestry, a study of moisture and volatile oil in relation to strength of timber.

A large force of men is at work reconstructing the interior of the build-

ing, which can now be adapted closely to the various needs of the school. It is expected that all classes will be resumed without interruption at the opening of the term on January 9.

An idea of the loss may be gained from the fact that the insurance allowed by the underwriters is \$17,000.



Water and Forest Convention.

The annual meeting of the California Water and Forest Association was held, in accordance with the provisions of its by-laws, on Thursday, December 10, at 10.30 a. m., in the rooms of the Chamber of Commerce, San Francisco.

The reports of the Bureau of Forestry and the Geological Survey upon the work being done in California were not available at this date, and, as no business of importance was to be transacted, the meeting was adjourned until some day in April, when the reports will be available. The date and place will be announced later.

At the adjourned meeting the question of future legislation will be taken up, more especially such legislation as may be deemed advisable to amend the water laws of California, and all suggestions on this point will be received. After the reports of the investigations have been received it will be known whether it will be necessary or not to appear before the next legislature of California with a request that the appropriation made by the state at its last legislature for the purpose of conducting investigations in connection with the departments at Washington should be continued for the years 1905 and 1906.



Massachusetts Forestry Association.

The sixth annual meeting of the Massachusetts Forestry Association was held December 10, in Boston, at the rooms of the Twentieth Century Club. The reports of the secretary and treasurer were read. Mr. T. F. Borst, forester of the association, gave a short account of his work of the last few months. The following officers were elected for the ensuing year:

President—Henry P. Walcott, of Cambridge.

Vice-Presidents—Lucia A. Mead, of Boston; William C. Whitney, of New York and Washington; William F. Gale, of Springfield; Mary L. Ware, of Boston; James S. Russell, of Milton; Charles Francis Adams, of Lincoln; Richard T. Fisher, of Washington, D.C. Secretary and Treasurer—Edwin A. Start, of Billerica.

Additional members of Executive Committee—James H. Bowditch, of Brookline; Frederick L. Olmsted, Jr., of Brookline; J. Rayner Edmonds, of Cambridge; Katharine W. S. Noble, of Boston; Mary L. Tucker, of Newton; Allen Chamberlain, of Winchester; Harold L. Frost, of Belmont; Emma G. Cummings, of Brookline; George B. Inches of Grafton; Edmund S. Clark, of Framingham; Richard A. Hale, of Lawrence; Cora C. Stuart Jones, of Boston.

Auditing Committee—Frederic Cunningham, of Brookline; George M. Weed, of Newton; Harlan P. Kelsey, of Salem.



New Forest Organization. It is reported by Mr. William R. Lazenby that at the annual meeting of the Ohio State Horticultural Society, held at Delaware, December 9-11, the Ohio State Forestry Society was organized with about 50 charter members.

The object of the society, as stated in the simple constitution adopted, is as follows: "To develop a public interest in forestry by disseminating knowledge of trees and tree planting; by encouraging the preservation and improvement of the existing forests and woodlands; by inciting the more general use of trees for shelter, shade, and ornament, and the growing of trees as a farm crop, and by cooperating as far as possible with the work of the United States Bureau of Forestry and that of the American Forestry Association."

It is expected that the first regular meeting will be held at Columbus about the middle of January, 1904. The officers are: W. I. Chamberlain, Hudson,

Ohio, president; J. L. Shawyer, Bellefontaine, Ohio, vice-president; William R. Lazenby, Columbus, Ohio, secretary-treasurer. The new organization seems to have started under favorable auspices, and it is hoped that it may become a power for good.



Notes from the Exposition. In the display of Great Britain will appear a large model of the Asuan Dam, which is now adding so greatly to the agricultural welfare of the valley of the Nile River. This great achievement of hydraulic engineering was fully described in the December number of FORESTRY AND IRRIGATION in 1902.

The model measures 4 by 16 feet and is the property of Sir Benjamin Baker, the engineer of the dam.

An exhibit will be made under the auspices of the International Society of Arboriculture intended to set forth the good qualities of *Catalpa speciosa*.

The rapid growth of this tree will be shown in one part of the exhibit; in another will be specimens of *Catalpa* telegraph poles, fence posts, and railroad ties which have been in use for long periods of time and successfully resisted decay.

As an illustration of the physical qualities of the wood, a car-building firm of Dayton, Ohio, will exhibit a section of a palace car, all the wooden parts of which, inside and out, are made of *Catalpa*. Furniture made of *Catalpa* will also be shown.



Iowa Park and Forestry Association. The Third Annual Assembly of the Iowa Park and Forestry Association occurred at Des

Moines, Iowa, December 7 and 8. Five meetings were held, at which a number of instructive papers were read, new officers elected for the ensuing year, and a movement set on foot to bring about the enactment of laws providing for exemption of taxes on woodland. The association intends to start a vigorous campaign of education.

The papers reported as read were as follows: Chemistry in Relation to For-

estry, Dr. J. B. Weems; Hardy Herbaceous Perennial Plants, Mr. Wesley Greene; Lawns and Lawn Making, Mr. C. R. Ball; Ornamental Hedges, Mr. E. E. Little; Street Trees, Prof. A. T. Erwin; Our Iowa Birds, Hon. John Bailey; Railroad Planting of Parks, Mr. J. Sexton; Tree Planting, Why it Fails, Thos. H. Douglas; Phenology of Our Trees, Charlotte M. King; The Systematic Agitation of Bettering Our School Grounds, Supt. C. R. Scroggie; Some Forestry Conditions in Iowa, Prof. L. H. Pammel; Advancement in American Forestry, Prof. E. E. Faville; The Architect and Landscape Artist, Mr. O. H. Carpenter; Forestry in Our Public Schools, Hon. Henry Sabin; Tree Planting on Our Northern Prairies, Col. W. A. Burnap; Civic Improvement, Dr. F. L. Rogers; Native Shrubs of Iowa, Prof. B. Shimek; Parks for Small Cities and Villages, Mr. Frank H. Nutter, Minneapolis, Minn.; Tree Planting in Northwest Iowa, Prof. B. Shimek; Philip Madison Crapo, a Tribute, Rev. Edwin McMinn; Wind Breaks, Henry Wallace; A Systematic Study of Trees in Our Public Schools, Miss Grace Troutner; President's Address, Prof. T. H. Macbride.

Officers of the Association for 1904—President, Prof. Thos. H. Macbride, Iowa City; vice-president, Mr. Wesley Greene, Davenport; secretary, Prof. L. H. Pammel, Ames; treasurer, Mr. John Bailey, Charles City.

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University of Michigan Forest School. Professor Roth and four of the students at the Forest School took advantage of the holiday recess to visit some of the great logging works in the Lake States, the managers of which had extended cordial invitations to them.

Two of the men went to the Weyer-

hauser camps, in Minnesota, and the other two saw the logging operations of Henry Stephens at Waters, Mich., and those of the David Ward estate, at De Ward, Mich.

Alaskan Forest Reserve. The Thursday evening open meetings of the Society of American Foresters at the residence of Mr. Pinchot, in Washington, which have proved so instructive and entertaining during previous winters, have been resumed for the season of 1903-1904.

On December 17 Mr. W. A. Langille, of the Bureau of Forestry, gave a talk, illustrated by stereopticon views, on the proposed forest reserve in southeastern Alaska. This territory extends 330 miles southeast from Skagway, and forms a strip 30 miles wide on the mainland along the western side of British Columbia, the boundary running through the Coast Range Mountains. It was examined by Mr. Langille during the past field season.

The country, which also includes the numerous large islands along the coast, is very rough and mountainous. On this account, and also because the soil is extremely scanty, there is practically no opportunity for agriculture. The rainfall will average about 80 inches.

Timber grows on the slopes up to snow-line, wherever it can find subsistence. In a few places heavy stands of Spruce are found, most of which is already "scripped" or staked as mineral lands. Hemlock is the prevailing timber tree, and is reproducing vigorously in all localities. Spruce (*Picea sitchensis*) is second in importance as a type on account of its less frequent occurrence, although it attains much greater dimensions than Hemlock. One-fifth of the entire area will cut 15,000 to 20,000 feet of lumber per acre. A large proportion of the timber is rendered useless by rot, starting from heart-shake and frost cracks.

The population of the territory embraced in the proposed reserve numbers 10,000, and the main occupations of the people at present are fishing and lumbering, though the hope and future wealth

of the country lies in its mineral resources. Indians bring logs to the mills at such low rates that white men can hardly compete in this kind of work.

Mr. Langille believes that very little restriction should be put upon the lumbering of this region. Apparently the difficulties attendant upon developing the country are great, considering the amount of profit in view, and the people need encouragement to induce them to settle and open new enterprises.

Indictments for Illegal Fencing.

The United States grand jury at Omaha has made a partial report, returning indictments charging illegal fencing of public lands against ten wealthy ranchmen of central and western Nebraska. True bills are found against Bartlett Richards, president of the Nebraska Land and Feeding Company; W. G. Comstock, vice-president of the same company, and Secretary Charles C. Jameson, all of Ellsworth, Neb., and former State Senator Frank M. Currie, a large individual cattle owner of Broken Bow, Neb. The other seven indictments are against extensive ranchmen of Cherry and Custer counties. Each of the ten indictments in the land-fencing cases contains three counts, and all are similarly drawn. They charge, first, erecting a fence in violation of the law pertaining to government land; second, maintaining said fences, and, third, obstructing passages across government lands.

The illegal fencing of these lands, which are located in Cherry, Custer, and other large counties in western Nebraska, was brought to the attention of the Interior Department several months ago. W. A. Richards, special land commissioner, and Col. John S. Mosby were delegated to investigate the matter, and as a result it was left in charge of District Attorney W. S. Summers. John B. de Freeze, a special agent, was sent to the range country to secure evidence, and is said to have worked up 132 cases where government land has been fenced. About 700 ranchmen are said to have fenced in about 6,000,000 acres.



VIEW SHOWING INTERIOR OF THE GREAT ASSUAN DAM ON THE NILE AT LOW WATER

Among the largest of these tracts was that of the Nebraska Land and Feeding Company, of which Bartlett Richards was president. His range extends over more than 200,000 acres, and is about 100 miles long. Richards is said to be the largest cattle buyer and owner in the world, and is rated as a man of immense wealth.

Frank M. Currie, who was also indicted for alleged illegal fencing, is an extensive ranchman of Custer county. He represented his county as state senator in the legislature of 1901-'02, and was a candidate for United States Senator to succeed Senator Allen.

The land-fencing cases have excited intense interest because of the large number of wealthy and influential ranchmen concerned and because of charges, some of which have been filed in Washington, that certain public officials were in collusion with the ranchmen to prevent an indictment.

The foreman of the grand jury stated to the court that the jury would later have a supplementary report, and it is said that this addition will include several more indictments of prominent ranchmen.

Death of a Forester.

It is learned from reliable sources that Mr. S. Y. Hills, of the Bureau of Forestry, in the Philippines, was

killed by alligators, on some date previous to September 30, while swimming in the estuary of the Rio Grande, at Cottabato, in the island of Mindanao. The mutilated body was recovered.

Mr. Hills, who was unmarried and had not yet attained his thirtieth year, was a Vermonter who went to the Philippines as a volunteer in the military service. He was transferred to the Bureau of Forestry largely on account of his proficiency in the Spanish language and his general education and intelligence. He had become one of the two American inspectors who act as assistants to Captain Ahern, inspect timber cutting, and superintend the corps of rangers.

On account of his attractive personal qualities, Mr. Hills was a favorite among his associates in the Bureau and had many friends in the city of Manila.

Canal at Grand Valley, Colorado.

Preliminary surveys by the United States Reclamation engineers in the Grand Valley, Colorado, have shown conclusively that a high-line canal is not there practicable. At the same time the engineers agree that a low-line canal, covering a comparatively large area, is feasible, and that the cost of its construction would not be too great. As the community is wealthy, and as the local sentiment is

somewhat divided as to the propriety of the government's engaging in this work, it has been decided to leave the project with the citizens, for it is the policy of the government not to assume the management of such projects as are capable of being handled by private capital.



Pennsylvania Railroad Planting Trees. The Pennsylvania Railroad Company has lately completed the work of planting 50,000 young locust trees on land which the railroad purchased a few years ago west of Cone-wago Station, Pa. One hundred and twenty-five men were employed on the work, which occupied them for three weeks.

An official of the company says that it is the purpose of the company to plant 1,000,000 trees in the next four years. The timber is to be used for railroad ties.



Government Salaries. The scale of the salaries paid to employes of the federal government was arranged in the days of Jeffersonian simplicity. The intention of the Fathers in making the remuneration of government service small was both to avoid the burden of heavy taxes, under which the people had struggled in Europe, and to remove the attractiveness of public office for unscrupulous men who might obtain appointments with the emolument only in view.

The idea worked well enough in its day. In fact, its success up to the present time is surprising. The wonder is that the government has been able to hold men of the grade which has always administered the bulk of national affairs on salaries so low.

The times have changed; life has become more complex and expensive. Young men hesitate to marry on stipends which their fathers considered ample. Specialists in the sciences are absolutely necessary in the departments, each of whom has prepared himself for his work by a long and expensive technical education. In private business these men are valued highly and paid accordingly.

But the United States continues to pay its servants, from the President down, on the scale that Jefferson considered ample.

Business men especially notice this state of affairs, for they know what they have to pay for the services of a good man. The *Pacific Coast Miner* says editorially:

"We notice that the United States government advertises civil service examinations for positions of local land office clerks. In this it is stated that the applicants must have a thorough knowledge of the public land laws and of the routine of land-office work. For all this he is to receive a salary not equal to that of a San Francisco hod-carrier. As the registers and receivers are political appointments who exercise judicial functions and yet seldom have any knowledge of law, the clerk is supposed to be their law adviser, and as such must be able to cope with the most skillful land thieves that the world has ever known!"

"It is said that the miserable salaries paid to skillful brain workers in all departments of our government are such that in many cases some civil-service examinations cannot be held for want of applicants. This will continue until the government realizes the fact that brain work requiring technical ability and years of study is entitled to as much consideration at its hands as the mere manual laborers of the trades unions. As the President is the head of the civil-service system, we respectfully call his attention to this state of affairs. The efficiency of every department of the government must depend on the efficiency of its employes, and this efficiency cannot be secured without the compensation appropriate to ability, experience, and relative value."



Christmas Trees. Before the middle of December the city dealers begin to receive and display their stock of Christmas evergreens. In the northern cities a profusion of Arborvitæ, Spruce, Balsam, and Hemlock is shipped in by boat and rail, varying in size from branches and small bushes to trees 30 feet in height.

The Arborvitæ is mainly utilized by stripping away the twigs bearing the foliage and tying them into wreaths and garlands.

Here in Washington the Spruce and Hemlock are seen in addition to Scrub Pine, Red Cedar, and a little Longleaf Pine from the Carolinas. For wreaths, instead of Arborvitæ the dealers display quantities of a Lycopod or Club Moss, commonly called Crowfoot, which resembles the Arborvitæ in appearance, but lacks the attractive fragrance of the conifers. Holly appears later, and mistletoe last of all, because it is liable to wither.

The well-shaped trees from 6 feet and upward in height do service as the Christmas trees, which contribute so much to the pleasure of children at the holiday season.

This year a complaint was heard, especially from the northern cities, that Christmas trees were too expensive to be used as generally as in years gone by. The supply is decreasing. This is a matter for regret. The Christmas tree is a strong accessory to a good home. It is a part of the birthright of childhood, and its enjoyment should not be limited to the homes of the wealthy.

Undoubtedly there are enough young evergreen trees in the North to furnish us indefinitely with Christmas trees if we use them wisely and eke out the supply. The rise in price means only that the well-shaped trees which grew conveniently near shipping points have been exhausted, and that the dealers now have to bear the expense of longer hauls.

Here is an opening for thrifty northern farmers. A few pounds of spruce and balsam seed each spring scratched into the ground on the shady side of the fences, or in the open places in the farm woodlot, would yield enough Christmas trees after a few years to buy a handsome gift for each one of the family. They are already raised at a profit by nurserymen.

There should be no wanton waste or destruction of the young forest growth. FORESTRY AND IRRIGATION would be first to condemn such proceedings as are reported to have taken place this

year at Philadelphia, where a large number of trees were burned by the dealers in order to raise the price of the remainder.

But the attitude of the sentimentalists who would cut no trees, even for Christmas purposes, is equally mistaken. Such persons are a serious hindrance to the progress of real forestry, for they antagonize the very men they would like to convert. Let every home that needs a Christmas tree have one, by all means, for this legitimate use, but cry down indiscriminate cutting and waste in the woodlands, and prepare for 1914, if you are in a position to do so, by planting a few spruces or firs.



Forest Fire Notes.

The scene of principal damage during December shifted after the first few days of the month from eastern Texas to southwestern California.

From various newspaper items it is learned that on December 3 fire broke out in the mountains 20 miles northeast of San Bernardino, which proved to be the most destructive in the history of that region. It was believed at first that it started from a donkey engine at the works of the Brookings Lumber Company, but investigation seems to indicate incendiary work on the part of several persons and arrests are promised.

The flames moved southward, driven by the wind, and burned about 5,000,000 feet of sawed lumber at Brookings' mill, entailing a loss of more than \$100,000 to the company. The mill was saved.

A summer cottage at Fredalba was destroyed and a bridge 200 feet long, which spans City Creek Canyon, was seriously threatened, but finally saved by back-firing.

The area burned over is estimated at nearly 40,000 acres, upon which stood some of the finest timber in the San Bernardino Range. The main loss lies in the denuding of the mountain slopes, from which almost all vestiges of plant life were swept away. The soil was so calcined that it will readily wash away, leaving the naked rock. December 6 the fire was said to be under control.

On the same date a report from Santa Monica, Cal., announced that 30 miles of the coast in that region had been devastated by forest fires, which worked in and out of the canyons and destroyed a number of residences, at a loss of \$150,000.

At Escondido much damage resulted from a fire which burned the Escondido Irrigation Company's district flume line in several places. Repairs will cost \$30,000 to \$40,000.

Less destructive fires are reported from Parksville, Ky. (November 30), from Wrightsboro, N. C., and from Blaine, Ill.

It is worthy of note that during the last fiscal year 597 camp and other small fires were discovered burning in the forest reserves and extinguished by the rangers while in the incipient stage.

There were also 279 larger fires, of which some few escaped control and burned over considerable areas. Altogether, more than 280,000 acres were burned in the reserves.

Several counties in the Adirondack region of New York State, following the leadership of St. Lawrence county, are endeavoring to move the legislature to such action as will cause the expense of fighting forest fires in the future to be borne wholly by the state, instead of throwing half the burden on thinly settled, poor towns, as at present. The supervisors of the affected towns say that much of the expense in the heavy fires of last spring was for the protection of state land, and that as the Adirondacks are used by citizens of the whole state as a pleasure resort, these citizens should help stand these expenses.

Geological Survey Exhibit at St. Louis.

The space allotted to this important bureau will be utilized as completely as possible with an exhibit illustrating

the various lines of work carried on by the several branches of the Survey.

Twelve colored photographic transparencies will represent typical landscapes in various quarters of the United

States, and show the men of the field branches at their work, on the march, and in camp.

Of great interest to partisans of irrigation will be two large scale models of the engineering work of the government reclamation projects at the Gunnison River in Colorado and on the Salt River, near Mesa, Arizona.

The former shows the diversion of the water of the Gunnison River to the Uncompahgre Valley by means of a tunnel $6\frac{1}{2}$ miles long. The latter is a working model, 7 by 21 feet in extent, which is meant to demonstrate with actual flowing water the action of the immense dam and the canal by which electric power is developed to aid in its construction.

The towers and gates by which the water is let out of the reservoir into the stream bed appear in operation, and farther down the stream are seen the head-gates, flumes, division gates, measuring weirs, etc., which control and regulate the flow of the waters to the irrigated lands.

The orchards, vineyards, orange groves, and field crops resulting from the application of water to the land form part of the model, and each object is painted to resemble the actual present appearance of the locality.

Professor Graves Married.

Prof. Henry S. Graves, director of the Yale Forest School, was married on December 19, at New Haven, Connecticut, to Miss Marian Welch, daughter of Mr. Pierce Welch, of that city.

The Land Grabber at Work.

This from a prominent citizen of New Mexico: "The land grabber is working overtime in our territory, and his latest scheme works like a charm. In the Pecos Valley the desert entrymen rent a pumping plant, set it up before the inspector arrives, and soak up a few acres. Title passes to the entryman, and the pump is returned or passed on to the next would-be land owner."



HON. THOMAS R. BARD,

CHAIRMAN OF THE IRRIGATION COMMITTEE IN THE UNITED STATES SENATE.

THE friends of national irrigation are rightly pleased at the appointment of Senator Thomas R. Bard, of California, as chairman of the Irrigation Committee of the United States Senate. He has labored long and diligently for the upbuilding of the West, and has always stood for the rights of *bona fide* settlers. Senator Bard has long been identified with the great business interests of the West, in which he has won marked success, and his service in the Senate, though short in point of time, has been stamped by the same sound judgment and adherence to right principles that has made him such a power in his own State of California. Senator Bard was born at Chambersburg, Pa., December 8, 1841. After graduating from Chambersburg Academy at the head of his class he studied law. He then engaged in the transportation business, and later, in 1865, went to southern California, where he has resided ever since. He was elected to the United States Senate in February, 1900, by the unanimous vote of the Republican members of the legislature. In addition to being chairman of the Irrigation Committee of the Senate, Senator Bard is also a member of the Committees on Indian Affairs, Public Lands, Railroads, and Territories.

AMERICAN FORESTRY ASSOCIATION.

TWENTY-SECOND ANNUAL MEETING WAS HELD
AT WASHINGTON, D. C., DECEMBER 9, 1903.

I. Minutes of the Meeting and Resolutions.

THE twenty-second annual meeting of the American Forestry Association was held in accordance with the constitution on December 9, 1903. The meeting was called to order at the Atlantic Building, Washington, D. C., at 10 o'clock a. m., by Honorable James Wilson, Secretary of Agriculture and President of the Association. The attendance was excellent and a lively interest was shown in the work of the Association.

The reading of the minutes of the last meeting was dispensed with, as they had been printed in full in *FORESTRY AND IRRIGATION* for January, 1903.

The Treasurer, Mr. Otto Luebker, read his report, showing total receipts of \$4,566.31 and expenditures of \$4,077.59, leaving a balance on hand of \$488.72, against which there are outstanding bills for \$50.00. The report was accepted and referred to the Auditing Committee.

The Secretary of the Association, Mr. Bowers, read the report of the Board of Directors, which was accepted, and, on motion, ordered to be printed in *FORESTRY AND IRRIGATION*.

Mr. Pinchot announced the names of those who had contributed to the special fund for increasing the membership and advancing the work of the Association, the list being as follows: Mr. William Earl Dodge (now deceased), Mr. D. Willis James, of New York; Mr. Morris K. Jesup, New York, and Mrs. Elizabeth S. Potter, wife of Bishop Potter, of New York.

He moved a vote of thanks to these ladies and gentlemen for their valuable assistance, which was unanimously carried.

On motion, the chair was authorized to appoint the usual committees, and in accordance therewith he named Messrs. George B. Sudworth and Wm. L. Hall as the Auditing Committee; Messrs.

Edward A. Bowers, F. H. Newell, and Overton W. Price as the Committee on Resolutions; Messrs. Gifford Pinchot, George P. Whittlesey, George F. Moses, Colonel William F. Fox, and Dr. C. A. Schenck as the Committee on Nominations.

Secretary Wilson was at this point obliged to leave, and called upon Mr. Gifford Pinchot to take the chair during his absence. Mr. Pinchot thereupon requested Mr. Ernest Stewart, Superintendent of the Canadian forests, to take his place on the nominating committee.

Dr. Schenck then addressed the meeting upon the subject of forestry in North Carolina, and was followed by Mr. Low, of Hawaii, who spoke interestingly upon forest conditions in the islands.

After some further discussion, Mr. Pinchot extended an invitation on behalf of his mother, Mrs. James W. Pinchot, to all present to attend a tea at No. 1615 Rhode Island Avenue from 4.30 to 6.30 that afternoon.

A recess was then taken at 11 o'clock until 12 o'clock noon.

At the afternoon session Mr. Bowers, for the Committee on Resolutions, read the proposed resolutions, which were then taken up for discussion and finally adopted. These resolutions are printed below as a part of this report.

The Auditing Committee reported that the Treasurer's accounts were correct, and their report was accepted and placed on file.

The Nominating Committee reported a list of officers for 1904, and upon the acceptance of their report the Secretary was directed to cast the ballot of the Association for the nominees. This list is printed on the Association announcement page in the January number of *FORESTRY AND IRRIGATION*.

Mr. Stewart, Superintendent of Canadian forests, suggested that next summer the American Forestry Association

have a joint meeting with the Canadian Association at St. Louis.

Dr. Schenck thought that this meeting should be an international one, and Mr. Bowers offered a resolution that this association appoint a committee to take charge of an international forestry meeting at St. Louis, and that the committee consist of Dr. Tarleton H. Bean, Mr. Gifford Pinchot, and Mr. Ernest Stewart, with such other members as they may desire to associate with them. This resolution was adopted unanimously.

Mr. Stewart then made some interesting remarks upon the progress of forest work in Canada, with especial reference to the success that had attended the effort to distribute young trees for planting by farmers.

After some discussion of tree planting by Mr. William L. Hall, Mr. Stewart, and Mr. Ernest Bruncken, the meeting adjourned.

The tea at Mrs. Pinchot's was largely attended, in spite of the inclement weather, and this pleasant opportunity of meeting socially was greatly appreciated.

RESOLUTIONS.

The following resolutions were unanimously adopted by the Association:

WHEREAS the southern mountain forests are of national importance in their influence upon stream flow and upon timber supply, and whereas widespread loss has already resulted from their misuse,

Be it resolved, That this Association lend its best efforts to procuring the creation of a national forest reserve in the Southern Appalachians.

Resolved, That this Association, in its capacity as a national organization, endorse the effort to obtain a forest reserve in the White Mountains of New Hampshire.

WHEREAS experience has demonstrated that the first step in an effective administration of great forest areas is rapid and easy means of communication, in order that fires may be extinguished in their incipient stage and depredations anticipated:

Be it resolved, That the officers of this

Association are hereby instructed to make every proper effort to obtain from Congress at this session an appropriation of five hundred thousand (\$500,000) dollars, to be expended in the construction and improvement of roads and trails within the existing national forest reserves.

Resolved, That the existing laws under which mineral entries are made within forest reserves are a menace to the reserves, and that said laws should be so modified as to prevent mineral entries for other purposes than the development of mineral resources, while affording the *bona fide* prospector full opportunity to perfect a mineral claim.

Resolved, That we favor the passage by Congress of an amendment to the law regarding exchange of lands included within a forest reserve, so that such exchanges or lieu selections shall be confined to lands of equivalent value or similar condition as regards forest growth.

Resolved, That we are in entire accord with the efforts to repeal the Timber and Stone Act, and we favor as a substitute therefor the passage of an act which shall confer authority upon the proper officer of the United States to sell timber growing on the public lands when such sale shall be for the public welfare.

II. Directors' Report.

Advance of Forestry. The forest movement in the United States has progressed so satisfactorily during the past year that your Directors feel justified in opening this report with an exultant note. In no previous year has there been so solid an advance in gaining public support. The lumbermen and railroads have become convinced that forestry is of the utmost importance to them, and we welcome such support as a notable achievement of the year.

Public sentiment, too, in the West, where the federal forest reserves are located, has changed from an attitude of hostility to one of friendliness, and we confidently believe that it only requires a more complete understanding

of the purposes of the reserves to bring to them a practically unanimous support of the people in the states where they are located. It should be the duty of this Association in every way to further this result.

In submitting our annual report to the members of this Association, it seems desirable to first take up the matters of general interest that were incomplete at the time of our last annual meeting, and thus make a more or less continuous history of our activities in the forestry movement.

Consolidation of Forest Work.

1. Of prime importance is the consolidation of the forest work of the federal government under one head. It is hardly necessary to repeat that the present division of the work between the General Land Office, the U. S. Geological Survey, and the Bureau of Forestry is unsatisfactory, unscientific, and uneconomic. This condition is recognized by all the parties concerned. The President, the Secretary of the Interior, the Secretary of Agriculture, and the Commissioner of the General Land Office have united in asking Congress to place all forest work of the government in charge of the Bureau of Forestry. This Association, the National Irrigation Congress at its meeting in Ogden, Utah, last September, and many other organizations have endorsed this proposed consolidation, but as yet Congress has failed to act. A bill is now pending in Congress to accomplish the desired object, and it is hoped that in view of the unanimity of those in a position to judge of its merits that the bill will pass at this session. Of course the questions arising in connection with the reserves as to titles must continue to be adjudicated by the General Land Office.

Southern Forest Reserve.

2. Another important matter is the proposed Appalachian Forest Reserve, which this association has earnestly advocated. No legislation has been obtained creating it as yet, but public sentiment continues to support it with increasing force, and it is reasonable to

expect that in time Congress will act favorably upon the matter.

The Legislative Committee.

3. In pursuance of a resolution passed at the last annual meeting, your President last spring appointed a Legislative Committee to consider what could be done in the way of obtaining forest legislation in the different states. This committee has considered what its work and scope should be, and has decided that the first and most practical piece of work for it to do is to try to devise a harmonious system of tax laws with reference to forested or wooded lands. At present it is collecting information concerning the cut-over pine lands of the South and gathering the opinions of the owners of such lands as to what form of tax exemption or tax postponement would induce owners to interest themselves in reforesting such lands. The existing laws tax lands producing a wood crop upon the value both of the land and the crop. This is not done with other crops in most states and is an unfair discrimination against forest properties, inducing the earliest possible cutting of wooded lands. It has been suggested that the only fair way is to tax the wood crop when it is gathered, and until that time only place a tax upon the value of the land itself. If some general law upon these lines can be framed which will apply in most states, we believe the association could do most important work in having it presented to the legislatures of all the states, furnishing such explanations as might lead to favorable action in many states.

Affiliation With Other Associations.

A new piece of work has been attempted by the Secretary this year in endeavoring to affiliate existing state forestry associations with this organization and to organize branches in states where no forestry organizations exist. This matter has been under consideration for many years by our Executive Committee, but no practical way of accomplishing so desirable a consolidation of all our voluntary forest interests was found.

It is now hoped that something may be done along this line, and we urge our members in the different states to present such plans to our Secretary as seem to them wise in order that some affiliation between all state associations with this national association may be effected.

It has been suggested that the Association should annually make inspections of the work on the national forest reserves with a view to assisting by its coöperation in a proper management of the same. This seems desirable, but at present our resources will not permit us to attempt this, save in isolated cases.

Membership of the Association.

At the time of our last annual report the total membership of the Association was 2,136. At the present time it is

2,107, not counting some twenty or thirty members who have joined since the 30th of November. We may therefore say that our membership has been practically stationary during this year. This is not as it should be. While our members have not increased, in one respect the changes for the year are gratifying in that we have a larger membership from the far West and the membership is more widely scattered than a year ago. We can not dwell too strongly upon the importance of increasing our membership, both because of the financial strength gained, but also of the increased influence it gives us in furthering forestry throughout the country. We ought to have 10,000 persons enrolled as members of the American Forestry Association, and we believe we can obtain this number if each one of our members will make it his or her duty to see that at least five friends are by them induced to join during the coming year.

The Summer Meeting.

The summer meeting at Minneapolis, Minnesota, held on August 25 and 26, was in every way

a success, and the thanks of the Association are due to the Commercial Club of that city for its management of the meeting, which was held under its auspices. The papers read were pertinent and the discussions evoked by them most interesting. Secretary Wilson,

our President, was present, and, as the fitting climax of the meeting, addressed a mass meeting on the last evening of our gathering. There was a representative attendance from various parts of Minnesota and adjoining states, and a noticeable feature was the presence of some of the oldest and most prominent lumbermen of Minnesota and Wisconsin, who took part in the program and discussions with enthusiasm and the intelligence coming from life-long familiarity with the White Pine region. The press of the Northwest gave full accounts of the proceedings, and the meeting awakened a wide interest in a section of the country where we may hope for valuable support in the future. It was voted not to increase annual dues to \$2.50. (See p. 274, FORESTRY AND IRRIGATION, 1903.)

The Magazine.

The official organ of the Association, FORESTRY AND IRRIGATION, was increased in size at the beginning of this year from 48 to 64 pages, and has shown steady and gratifying improvement. Since January 1, 1903, 86,500 copies were put in circulation, an average of 7,375 per month. The total cost to the Association has been for the year \$3,462.86, about one hundred dollars less than for a smaller magazine the preceding year.

Coming now to a review of the forest movement generally, we have to note with great satisfaction the work of the Bureau of Forestry.

Bureau of Forestry.

Greater progress has been made by the Bureau during the past year than at any other period of its existence. Important lines of work already begun have been continued, and the Bureau has extended its activities in many directions. Leading lumbermen have begun to see the wisdom of conservative lumbering, which is another name for forestry, and have emphatically endorsed the work of the Bureau. At the convention of the National Lumber Manufacturers' Association at Washington forestry was made the principal subject of discussion. Important lumber interests have applied to the Bureau of Forestry for advice and

assistance in the management of their timber holdings, and work has been or is now in progress on the lands of the Northern Lumber Company, the Kirby Lumber Company, the Houston Oil Company, and others. On July 1, 1903, the area of private forest lands under the supervision of the Bureau amounted to 679,194 acres.

Next, in importance to the interest of the lumbermen is that of the great railroads, a number of which have applied to the Bureau for assistance in determining the advisability of the purchase and conservative management of forest lands for the production of railroad ties. The Bureau has also been in cooperation with several of the leading roads in an investigation of methods of wood preservation, the results of which will be exceedingly valuable in connection with the durability of railroad ties.

Increasing attention was paid by the Bureau during the year to work upon government lands. This included the study of various forest problems within the national forest reserves and the examination of areas to determine their suitability for new reserves. The passage of the National Irrigation Act had a most important bearing on the question of extension of forest reserves, since government experts are agreed that irrigation on a large scale is impossible without the preservation of the forests surrounding reservoirs at the headwaters of the streams.

One of the most hopeful signs of the year has been the desire of various states to cooperate with the Bureau of Forestry in a study of their forest resources. Work along this line has been going on in several states, notably in California and New Hampshire, whose legislatures made specific appropriations for the purpose, and in Maine, where the Forest Commission contributed to the expenses of the investigation.

An investigation of very great importance is that of timber tests. The advice of prominent engineers, manufacturers, and lumbermen was sought before the tests were inaugurated, in order that their results might be of the greatest practical value. The object of these tests is to determine the strength and

durability of the merchantable timbers of the United States.

In view of the enormous damage which has been done by forest fires in the United States during the year, the investigation of this problem by the Bureau is of special interest and value.

While the Bureau has utilized to the fullest extent and in the best possible way its resources in men and money, its possibilities for usefulness are out of all proportion to the funds at its disposal.

The activities of the General Land Office in connection with the forest reserves have greatly increased. One-third of

the Commissioner's annual report is taken up with forest matters. During the year 2,875,000 acres of land were added to the forest reserve area, increasing the total of that area to approximately 63,000,000 acres. Four new reserves were established during the year since our last meeting, and one in Porto Rico has recently been proclaimed. The area of previously existing reserves was increased by 1,443,440 acres, and was reduced by 62,080 acres in modifying the boundaries of the reserves. As no small part of the opposition to the reserves at the outset came from the inclusion of certain agricultural lands within their exterior boundaries, we feel that this work of modifying scientifically the boundaries of the forest reserves should be pushed as rapidly as the work permits.

The field force is now completely organized, resulting in great benefit to the service. This is especially appreciable in the decreasing number of destructive fires occurring within the reserves, which is directly due to the work of the forest force in both educating the people on the subject and extinguishing incipient fires. The figures given in the report regarding the suppression of fires conclusively show that the value of the services rendered by the force in preventing conflagrations is simply inestimable. This feature of the work alone constitutes a sufficient demonstration of the utility of the service.

The work of preserving the reserves from depredations continues also in a

state of improvement from year to year. Grazing within described areas has been judiciously permitted, and the methods adopted seem to have met with general approval.

Another important branch of the work, that of effecting sales of timber, has also been considerably expanded, as shown by the increase in amounts received from such sales, the report for this last year showing an aggregate of over \$45,000 actually paid in on such sales as against over \$25,000 for the preceding year. It is also shown that there still continues a growing demand for the free use of forest-reserve timber.

The appropriations made by Congress to defray the expenses connected with the administration of the federal forest reserves have been as follows: Under the act of June 11, 1896, \$25,000 were appropriated to pay the expense of a commission appointed to report relative to the establishment of forest reserves. Subsequent to this act appropriations were made as follows:

For the fiscal year 1899.	\$175,000
" " " " 1900	210,000
" " " " 1901	325,000
" " " " 1902	300,000
" " " " 1903	300,000
" " " " 1904	375,000

The above appropriations are used to pay the salaries and expenses of officers employed in the service. The force is made up of forest inspectors, superintendents, supervisors, and rangers of different grades. As it is impossible to continue in active service the entire number of officers during the whole year, on account of the limited appropriation, a number of rangers are *furloughed during the winter months*, when the danger from forest fires and trespass is not so great as during the summer. There were employed during the past year about 450 rangers, together with the necessary number of inspectors, superintendents, and supervisors. This number was maintained until October 15, when the force was considerably reduced. During the winter months there were employed, about 175 rangers on the reserves.

An important matter for legislative action in connection with the forest re-

serve is the present method of permitting mineral locations within the reserves, which is open to criticism. While we favor the freest opportunities for a *bona fide* exploitation of the minerals within the reserves, we feel that the existing laws are defective in that it is possible under them for large numbers of mineral entries to be made where no minerals exist in paying quantities, and where, when title is once passed to the entryman under a patent, all control of the lands passes from the general government. This is a serious menace to the proper administration of the forest reserves. Under these entries large quantities of lands valuable only for their timber or as hotel sites and pleasure resorts are being taken, and a nominal compliance with the mineral laws makes it possible for such entries to be perfected.

In addition to the work of the federal government, the states have also advanced in their forest development. In Pennsylvania the state reserves have been increased in area, as is also the case in Indiana. Important legislation looking toward fire protection and proper forest administration has been passed, among others, in Minnesota, New Hampshire, California, and Washington.

The State of Maine has appointed a trained forester, a graduate of the Yale Forest School, as a state officer to assist in its forest work, and Wisconsin has asked the Bureau of Forestry to nominate a forester to take charge of its forest work. Following an investigation of forest conditions in Hawaii, that territory has appointed a forester, in charge of the protection and development of the forests of the island.

Under the provisions of the so-called Morris Act, which provided for the creation of the Minnesota National Forest Reserve, the first selection of lands for the reserve has been made by the Forester. It covers 104,459 acres, upon which the marking of trees to be left standing after lumbering is now in progress under the supervision of the Bureau.

There is every prospect of the successful execution of the provisions of the

Morris Bill, in spite of the opposition of certain lumbermen interested in maintaining the old conditions of loose administration on the one hand and excessive profits on the other.

The Association welcomes and applauds the efforts of the women of California to secure the preservation of the Calaveras Grove of Big Trees, and its members are urged to give the movement countenance and support.

Our Canadian friends continue to show an unflagging interest in the cause of forestry, both in their own domain, where their forestry association is doing active work, and also by numerous additions to our numbers. One of their official representatives was present at the summer meeting of the Association in Minneapolis and voiced the interest of Canada in all that we do in forestry lines.

Forest Fires. Fire, the great enemy of our forests, has done its usual work of destruction during the last year. In the Adirondack region its ravages were unprecedented. Over 600,000 acres were burned over, causing a loss of not less than \$3,000,000. While perhaps only 30 per cent of this area was valuable as timber, for the purposes of the Adirondack Park all was valuable. The excuse given for these great fires in the Adirondacks was the prolonged and unusual drouth; but with the forest force there and the interest of large landowners and campers this should only have been an incentive to increased activity. The railroads were particularly to blame by their want of care and precaution in spreading these fires, some of which, it is true, were set for revenge or to obtain work in extinguishing fires. In Maine during the months of May and June, 1903, 271,000 acres of timbered lands were destroyed, or about 2 per cent of their area in that state, involving a loss of \$1,410,210. We can not here recite all of the fires in forests throughout the country, but the two cases above are typical, and show the importance of a thorough administration of the fire laws. In many cases these laws themselves are good, but in the absence of an effective administra-

tion are quite worthless. Our members could do no more effective work in the cause of forestry in their respective states than to give earnest attention to obtaining proper means for the administration of their fire laws.

Education in Forestry.

The development of forestry education is a matter of supreme interest to all the friends of forestry, and so we must record one great regret that the first school in this country devoted solely to forestry has been discontinued. The New York State College of Forestry was organized in connection with Cornell University in 1898 and enjoyed an immediate and increasing success. Its graduates were proving themselves men of great usefulness in widely diversified forest work throughout this country and in the Philippines. With a promised membership of one hundred for this year, its success seemed assured. Suddenly we learned that the Cornell authorities had decided to discontinue it, because the governor of New York had vetoed the bill granting the customary state aid to the school. It is not proper for us to criticise this action or the complications by which this veto was brought about. We can only deplore the unfortunate outcome as a distinct loss to the cause of sound forestry in the Middle States.

As an offset to this loss, Harvard University has inaugurated this fall a department of forestry, which promises well for the future, and at the University of Michigan the forestry department contemplated a year ago has become a fact. The University of Nebraska has also established a department of forestry.

The Yale Forest School has nearly double the number of students that attended last year, compelling an increase in the teaching force, and the affairs of the school are most prosperous. At Biltmore there is also an increased number of students, and Berea College of Kentucky is turning out a large number of students with a knowledge of forestry that will be of great service when the Appalachian reserve is created. The Michigan Agricultural College also continues its forest work with success.

In many other colleges courses in forestry are now given with a constantly growing interest.

From this summary of the forest work of the year we trust our members may

feel that they have cause for gratification for what has been done and determination to push on this incomparable work all the more vigorously for the future.

III. REPORT OF THE TREASURER.

Otto Luebker, Treasurer, in Account with the American Forestry Association.

DR.		CR.	
To Balance December 1, 1902.....	\$155 12	By "Forestry and Irrigation," December, 1902, to November, 1903, inclusive.....	\$3,462 86
Interest on bonds	180 00	Postage for Secretary.....	6 38
Interest on deposits	17 66	Postage for Treasurer.....	89 70
Dues of annual members.....	3,423 30	Salary of Treasurer and clerk hire.....	247 05
Sustaining memberships.....	425 00	Interest on \$1,000 loan.....	50 00
Life memberships.....	300 00	Expenses of Summer Meeting..	102 76
Donations	43 00	Printing and stationery.....	87 00
Sale of publications.....	19 98	Sundries, Secretary and Treasurer	27 84
Exchange	2 25	Rent of safe-deposit box.....	4 00
			\$4,977 59
		Balance December 1, 1903.....	488 72
	\$4,566 31		\$4,566 31

Against the balance for the year there is outstanding one bill of \$50 for stenographic services at the Minneapolis meeting, leaving a net balance for the year of \$438.72, a gain of \$283.60.

Special Fund for Secretary.

Dr. By contributions	\$2,000 00
Cr. To Secretary.....	500 00
Balance.....	\$1,500 00

Additional Assets.

Two Chicago and East Illinois 5 per cent bonds.....	\$2,305 00
Two Minneapolis and St. Louis 4 per cent bonds.....	1,982 50
Dues outstanding.....	658 00
	\$4,945 50
Loan on one Chicago and East Illinois bond.....	1,000 00
	\$3,945 50

Unpaid dues to the amount of \$658 are still outstanding, viz: For 1903, \$534; for 1902, \$112; for years previous to 1902, \$12.

On March 1, 1903, 48 members were dropped for non-payment of dues, the amount thus lost being \$202.

Respectfully submitted.

(Signed)

OTTO LUEBKERT,
Treasurer.

DECEMBER 1, 1903.



WINTER LOGGING.

HOW LOGS ARE CONVEYED FROM THE
STUMP TO THE STREAM IN OUR NORTHERN
WOODS—FROST AND SNOW AS FACTORS.

BY

ROBERT V. R. REYNOLDS.

NOTE.—For the accompanying illustrations of northern logging sleds we are indebted to the Eau Claire Mill Supply Company of Eau Claire, Wisconsin.—EDITOR.

FROST and snow are good friends to the northern lumberman. Until recent years it was quite impossible for him to carry on logging operations in an economical way without their powerful aid. Since the introduction of the steam logging railway the lumberman is not as dependent as formerly upon winter conditions, since he now can haul his logs at any time of the year; but it is safe to say that as long as logs can be driven down the northern streams at comparatively small expense, the first heavy fall of snow will be eagerly looked for and welcomed in the woods of the states where the northern pines grow.

Its habitat, as well as its valuable qualities, has helped to bring misfortune to the White Pine. Not only does it grow straight and tall and clean of bole, float like cork, and work readily under the carpenter's tools, but it must needs plant its roots where for a third of every year the heavens themselves provide material for well nigh frictionless roads, which reduce to a minimum the expense of transporting the log to the saw.

Let us suppose a case of a lumber firm which has bought pine stumpage in a new place and desires to market the timber. If the timber holdings are very extensive and valuable and the company is able to expend \$50,000 to \$100,000 on transportation, they will build a light railway from the timber to the mill, unless there is a very good driving stream near by. A railroad renders them independent of the seasons, and also admits of bringing out

any desirable hardwood which may be on their land; or if a logging road is already established which nearly connects the desired points, they may be able to extend it according to their needs and contract for its partial use. If a good driving stream is near by, they will probably save the timber nearest it to send out by driving in the spring.

If the timber land is not extensive, its owners will rely entirely upon driving to get it to the mill. Any other case cannot be supposed; otherwise they would not have bought the timber. A means of transportation is the first thing to be considered.

They have, then, say, a half dozen forties of pine two or three miles from the driving stream, on which, 30 miles below, the mill is located, either at the head of a navigable water or on some permanent railway line, from which a switch runs into the yards.

The superintendent lays his plans and does all the preliminary work possible during the summer and early fall. His object is to haul the logs from the cuttings and pile them upon the ice of the frozen stream and along its banks with the least possible expenditure of power, both of men and horses. Wasted power means loss of time, and time is the equivalent of money to him.

In the first place, he may have to clear the snags, rocks, or sunken logs from the bed of the stream to prevent trouble from jams during the drive.

Next he selects a "banking" place on the river as near as possible to the cuttings. This must be a place where thick and solid ice will form, extending



A PRIZE-WINNING LOAD.

far enough to hold a large portion of the intended cut. Before spring piles of logs will cover the surface, and the ice must be strong enough to bear the great weight until the work is done. The river bank at this point must be of such a nature that heavy sled loads of logs can safely be driven down upon the ice. If it is too steep, a graded roadway must be cut back through it, or the logs may be unloaded at the top of the bank and rolled down upon the river. Arrangements are also made to pile a quantity of logs on the bank, to be launched after the spring freshet.

The camp foreman (whom we will call O'Brien) then constructs the foundation of the logging road from the cuttings to the river. The timber next the stream has probably been already removed. If not, a way must be cleared through it, usually at least twenty feet

wide. Allowance must be made every quarter mile for turnouts, where opposing teams may pass. Rocks and stumps must be avoided or removed; hollows must be graded level if unavoidable. In descending from the higher land towards the river, the road may have to wind about the hillsides in order to reduce the grades. It may be necessary to bridge a gully or two. The swamps and boggy places are usually safe enough after a week of the northern frost, but should heavy snow come before severe frost, the ground may be so protected from freezing as to remain unsafe for a time. In such a case the snow must be shoveled away to expose the ground to the freezing action of the air, or a quantity of brush is thrown into the boggy places, upon which corduroy is laid, and the snow heaped over all to form the road.

It may be that the only practicable descent from a line of hills is through a narrow, rocky, water-washed ravine. The foreman will then have to blast away some of the stone, using the *débris* and corduroy to fill the spaces between the rocks.

The grade must always be gentle, the track not one-sided, the curves long and easy, and the route the shortest possible, though it may be better to go a half a mile further around than to have a long or steep slope which a *loaded* team must climb. To fulfill all of these conditions requires no little ingenuity and actual engineering instinct on the part of the foreman. At the cuttings the road forks, with a branch leading to each considerable part of the works.

At a convenient point alongside each branch road in the cuttings is constructed a skidway, which means simply a pair of big wooden rails, usually logs, laid parallel and at right angles to the road. The end next to the road is a little higher than the other, so that a sled can draw up opposite the skidway and have its load of logs rolled on it from the side.

In this way much of the hardest work, which is moving the log from the stump to the road, is obviated, since probably no tree is more than a quarter of a mile distant from a skidway.

The camps and stables are built at the same time the road construction is going on. All of this work must be completed before snow or severe frost. For several weeks the woods crew have been busy in the timber—felling, swamping, and skidding—and already the skidways are piled high with logs ready to be hauled to the river. A tree comes crashing down; the dead and living limbs are swiftly lopped from its trunk, and the men who felled it measure off the log lengths with a 4-foot stick, and soon saw the merchantable part into logs. If the country we are considering is Wisconsin, and the ground is still free from snow, a team of horses drags 3, 4, or 5 logs into a pile, all lying parallel, by means of a log chain and a great pair of tongs, similar to ice tongs, which grips each log, usually at the larger end, as they drag more easily butt foremost. Then comes another team drawing a single pair of heavy wheels 7 to 9 feet in diameter, fitted with a stout pole or tongue. A chain is slipped around the pile of logs about a third the way from the end which is to be foremost. The wheels are drawn astride of the pile at the same point, the team facing forward.

The traces are unhooked and the tongue disengaged from the neck yoke



LOGS ON THE SKIDWAY.



A TURN-OUT NOTICE THE RUT.



LOADING WITH TEAM.

and turned straight up in the air. This allows a chain which is wound about the axletree to unwind one-quarter of a turn, and as the tree is from 12 to 18 inches thick, the hook at the end of this chain is lowered a corresponding distance. The hook engages the chain which encircles the logs, and the pole is pulled down to its horizontal position by sending the team straight ahead, hauling on a chain fastened to the upper or forward end of the pole. This motion winds up the chain around the axle and lifts the forward ends of the logs clear of the ground. The axletree is made eccentric, so that when the pole has resumed its normal position the weight of the logs hangs from the axis of the wheels, and there is little tendency to lift the neck yoke. The team is then hitched to the pole, as usual, and away goes the ponderous and unwieldy load to the skidway, harness creaking as the horses strain at the

collar, axles clucking to and fro in the well-greased boxes, and pole vibrating under sudden side strains from the partial blocking of a wheel by a hillock or a hollow. The raised ends of the logs swing beneath the axletree and the other ends drag on the ground. Arrived at the skidway, the load of logs is dropped squarely across the skids at the end away from the road by driving out a fid which locks the chain around the logs. The logs are rolled to the road end of the skidway by hand and piled up layer on layer, two men working together with cant-hooks or "peavies," which multiply their power sufficiently to enable them to roll one log upon another.

So the work goes on until the skidway is full, unless the arrival of good sledding opens the road to the river.

After the first snow comes and wheels no longer work well, the logs are either snaked in singly by the tongs method (and this is by far the most common



A BADGER RUTTER AT WORK.

practice throughout the north, even before snow comes), or the butt is rolled upon a low sled, to which it is lashed fast and hauled to the skidway as before.

Foreman O'Brien may be delayed in his plans by failure of snow to arrive at the date when his road and camps are finished and the skidways piled full. He may have to lay off a number of the men until the desired "spell of weather" arrives.

He will probably keep steadily on with the cutting, for this must be finished before 3 or 4 feet of snow falls, as is very likely to happen later in the winter. As time is now plentiful, he may have the square corners beveled off from the ends of the logs so that

the chances of catching rocks and snags in a shallow stream, and thus causing a jam, are very much reduced.

Every night before rolling into his bunk he goes outside and scans the sky with the careful scrutiny of a man who feels a grave responsibility. Every night for a week the stars sparkle down through the bitter air like diamonds set in dark blue velvet. The trees crack like pistol shots. Fourteen inches of ice on the river already, and the road where it crosses the quaking bog is as firm as the Brooklyn bridge.

The eighth night O'Brien comes in with a grin. "Snow tonight boys, sure!" The air is noticeably milder, all but the brighter stars are blotted out,



A DOWN-HILL CHANCE. NOTICE SAND IN RUTS.

and a great yellow halo surrounds the moon. The wind shifts, and tiny snow flakes come rustling down through dead leaves and against the rough bark of the pines.

Next morning the snow is eight inches deep, and still falling in a business-like way. All that day it falls and part of the following night. The laid-off men come flocking in at nightfall to be ready for the next morning. The snow lies 18 inches deep on the level.

Long before daylight the cook and the cookee are heard bustling about, rattling pots and frying pans and causing the coffee-grinder to give forth a cheerful clamor, accompanied by spicy, appetizing odors.

The teamsters' lanterns are twinkling about the stables, where they are shoving hay into the racks and measuring out oats and currying their big pets preparatory to harnessing.

The horses are the best that money can buy for the purpose—big, slow-moving, gentle, intelligent, and able to pull "anything that has two ends," as their drivers say; \$600 is not an unheard-of price for a young, heavy, well-matched woods team, though, of course, the average is much lower. They have plenty of grain, and their drivers in general give them the most painstaking care. A blacksmith shop is set up in camp, and here the horseshoeing is looked after. The teams are sharp-shod. Collars are fitted accurately to avoid trouble from sore shoulders, and all harness is heavy and perfect.

By seven the men have had their breakfast of pork steak, fried potatoes, slap-jacks, maple syrup, and coffee. The teams are hitched to the logging sleds, and by the time the men can see to handle a peavey a sled stands in front of the skidway.

The sleds, which are built especially strong for their work, are of the four-runner pattern, carrying a stout, rectangular framework to receive the load. An iron pin at each corner prevents the load from sliding sidewise. A sled without its load, but including the chains, may weigh from $2\frac{1}{2}$ to 3 tons.

The logs are rolled on to the sleds by means of two movable skids leaned

against the load, layer after layer, until the boss loader thinks the limit of safety has been reached. When the top of the load is above the logs on the skidway, the power of a team is employed to roll the logs into position. This is done by fastening one end of a rope on top of the load, passing the bight down under and around a log on the skidway, and returning the free end across the load to a team on the opposite side of the road. When the team goes ahead at the word the log rolls up the movable skids in the bight of the rope, balanced and steadied by the peavies of a man at each end. In the cut a single block has evidently been used to change the direction of the pull of the team, probably because the roadway is the only place where the team can pull ahead. After two or three layers of logs are loaded on the sled, binding chains are passed around the load, holding it firmly to the framework below. Then two or three more layers of logs are rolled into place, and these also are bound in position by chains, and so the process is repeated until the load is large enough.

The first load over the new road will probably be a very small one. The road must be tested and prepared to some extent for heavy traffic. For this purpose (supposing, again, that we are thinking of Wisconsin) the rutter is sent over the road to prepare the permanent track. The rutter consists of a sled with long single runners, which pack the snow evenly and make gradual, easy curves where curves are necessary. A small snow plow on each runner plows out the deep snow from the path where the horses of the loaded teams must walk. Frequently a solid road of ice is built up by repeated sprinkling from a tank of water mounted on a sled. The ice may be 12 to 20 inches thick, according to the ease of getting water. Then a rutter is used, with knives mounted on the runners, which scoop grooves in the solid ice, in which the sled runners may track. In many of the Northern states, however, the rutter is dispensed with, and the sleds are made to track 8 feet wide.

A little leveling will be needed in one place, a bad rock or stump may have to

be removed in another, and, above all, the runner tracks must be packed firmly and make one continuous line for the whole distance. Every driver guides his team so that his sleigh tracks just as the rutter did, and, as all are of the same gauge, there is soon a hard, smooth pair of ruts on which a team can haul wonderful loads, especially as most of the slopes favor going toward the river. A few men will be kept constantly on road repairs. Where the track shows signs of wear they shovel snow upon it. Where there is a sharp grade, down which heavy loads must pass, they sprinkle the track with sand, as shown in the cut, to prevent the sleds from overrunning the horses. Frequently the ruts are wet down at night. This process repeated keeps the rut in smooth, perfect condition.

Excepting only an iron wheel rolling on an iron track, these ice roads oppose less friction to the pull of the horses than any other device for transportation

which men have yet been able to discover. Unless there are considerable grades to be overcome, a good team can haul from five to twenty tons on such a road after it has attained its best condition. The difficulty lies rather in starting the mass than keeping it in motion.

In any heavy sledding in very cold weather the steel shoes on the runners freeze fast to the snow if the load is allowed to stand still for a few minutes. It is then that a good team and driver display their qualities. If the horses are poorly trained and handled, they grow nervous after one or two failures to start the load and seesaw on the evener, pulling alternately instead of both at once. In fact, the best of teams would often be unable to start a load once firmly "set" if they pulled straight ahead, relying only on their strength; but the experienced driver pulls the team a few inches to one side, so that the tendency is to wrench the front



A FAIR-SIZED LOAD.

runners loose from the clinging ice crystals, but not too far, or the pole will certainly be broken. At a quiet word the big fellows move steadily into the collar, gently at first, but increasing their effort as they feel the resistance. Harder and harder they strain, the harness creaking and the great muscles of their buttocks ridged and shining. For six seconds they hang motionless; then another quiet word recalls them to parade rest. After a few moments the driver causes them to pull the tongue sidewise in the other direction, and again sends them forward. This time intelligence scores. Just as it seems the team should be stopped for fear of discouraging them, there is a squeaking, grinding noise as the frost lets go its grip, and the front runners move to the side, following the pole. Immediately the hind runners are wrenched loose, and the whole load moves forward, taking a little curve before returning to the ice ruts. If the load is very heavy and obstinate or has stood over night, the driver takes a block of wood for a fulcrum and pries up each of the runners in succession with a crowbar, in order to avoid danger of breakage.

It is almost needless to say that such a load as the large one shown in the first illustration is heavier than any in ordinary practice, and was probably made up mostly for the picture. Intense rivalry springs up among the drivers as to which team shall haul the heaviest load of the year, and this results in the hauling of some tremendous loads on the ice roads. But woe betide the unlucky team and driver when such an unwieldy mass gets beyond control on a grade. Then the utmost efforts of the team can hardly keep them from being overrun, and both horses and driver have often been injured or crushed to death.

Once the roads are in good condition, O'Brien keeps the haulers moving briskly. Advantage must be taken of the season, for a January thaw may ruin his road and block the work for a week.

So load after load of logs moves down the long grades to the river bank and out upon the ice, there to be rolled up and away to the further end of constantly growing orderly piles. Every log is marked with a deeply dented brand in the end, or a mark cut in the bark, or both. The scaler knows within a few thousand feet the amount of lumber which can be cut from the banked logs.



READY FOR THE DRIVE.

At last the signs of coming spring begin to be noticed. The remnant of the work is pushed through with all possible speed, and finally all of the logs are lying upon the ice or along the banks waiting for the breakup.

If the stream is liable to overflow its banks when the ice goes out, long booms may have to be built of logs chained end to end to prevent the logs from floating in among the timber and becoming

stranded when the flood subsides. At this point the winter work ends and the drive begins. Hitherto the men and the horses have transported the logs by their own muscular power, aided by the sloping, slippery snow road. Henceforward, in large measure, the men will merely direct and apply the action of enormous natural forces in the path of which they have placed the logs by their labors of the winter.

THE BUREAU OF FORESTRY.

EXCERPT FROM THE REPORT OF THE SECRETARY OF AGRICULTURE
FOR 1903, SHOWING THE PROGRESS MADE DURING THE PAST YEAR.

THE object for which the Bureau of Forestry exists is first of all to secure the highest permanent usefulness of the forests in the present and future interests of the country.

Lumbering of the forests now standing must go on to supply immediate needs. This has made it necessary to find how to make conservative lumbering profitable, and the great danger has been that the rising price and growing scarcity of lumber would not of themselves bring this about until none but inferior forests should be left on which to practice forest management.

It is a safe assertion that the lumber interests of the United States recognize today as never before that forestry has for them a practical commercial value; that the way is in many cases already open to them to consider conservative lumbering as a definite business proposition, and that this condition has been brought about entirely by the efforts of the Bureau of Forestry to deal with the concrete facts of a problem of national importance. The evidence of its success is not only the cases in which lumber companies have already begun to put into operation its plans, prescribing for particular tracts how to lumber with reference to future production, nor the applications which have been made for similar advice elsewhere, but to the surprising interest in the subject which has lately been evidenced among lumbermen generally.

It is greatly to be hoped that the Bureau of Forestry may not be compelled to let slip this opportunity for an important public service by inability to answer the demands which will be made upon it. Experience has shown its capacity to do this work. The wide knowledge of forest conditions and of methods of operation which it has gathered, and the organization which it has developed, fit it to undertake new problems with a probability of success which can be looked for in no other quarter. In so vast a country as ours, and under forest and economic conditions of such variety, the task of revolutionizing the long-established methods of an industry like the lumber business is one of enormous difficulty. On the ability of the Bureau of Forestry to demonstrate, as fast as opportunity permits, that it is *good business* for lumbermen to conduct operations with reference to future crops depends in large measure the success or failure of the attempt to preserve what should be our chief sources of timber supply. The proper equipment of the Bureau for this work is nothing less than a national duty, and I have recommended that the annual appropriation for its use be substantially increased.

ADVANTAGES OF COÖPERATION WITH PRIVATE OWNERS.

In coöperating with private owners the Bureau is not expending public money to benefit private interests. Scientific

forestry—that is, enlightened management based on an accurate forecast of what a forest can be made to produce in the future—is impossible without full knowledge of all the forces, natural and artificial, which affect its productiveness. This involves a careful study of lumbering methods on the one hand and of the forest itself on the other. The Bureau has now in its possession as the result of this coöperative work the tabulated results of studies in many states from Maine to California and from Florida to Washington, representing a total of recorded individual measurements in the forest, the number of which would mount to scores of millions.

This vast mass of material has been gathered mainly at the private expense of the owners, who have received the expert assistance of the Bureau. Its possession makes it possible continually to enlarge the field of forestry. It has been secured by making its accumulation go hand in hand with practical results. Every working plan prepared and put in operation has meant both the preservation of a source of national wealth and an addition to the knowledge necessary for the wise use of the public as well as the private forests of the land.

Two considerations must be urged in connection with present conditions. The first is that coöperation is now supplying the Bureau with what it needs for government work at a less cost than would be required to secure the same result independently. The second is that the speedy introduction of management on private lands is a matter of pressing importance. Forest preservation is necessary in the interest of the public welfare. Forest destruction on a large scale is now in progress. It can be checked only by showing that it is possible to use the forests without destroying them. The Bureau of Forestry is doing this, and there is no other agency which can do it. If the Bureau does not put forth every endeavor to introduce conservative management among private owners, the public interest will suffer.

While it is true that hitherto virtually everything that has been done in this country to introduce conservative man-

agement as a paying business has been done by the Bureau, it is far from my wish that the Bureau should continue to control operations for private owners any longer than there is a clear and imperative need. It has already entered on the policy of detaching from its staff competent men to take charge of private operations when called upon to do so, in spite of the fact that it needs the services in its own work of all the trained foresters it has as yet been able to secure. The government service, however, is the natural goal toward which most ambitious students of forestry will strive, because of the superior opportunities of training which it affords.

SCIENTIFIC INVESTIGATION OF FOREST PROBLEMS.

There is danger that the attention which the work of the Bureau in promoting the actual management of forests naturally receives may obscure the importance of the investigations which it is conducting along other lines. These investigations are largely scientific in scope and method, but always entirely practical in purpose and outcome. The Bureau is the recognized source of information for the country on all forest subjects. The volume of its great and growing correspondence, due to this, is one evidence of its usefulness. It is conducting experiments along lines which have received the enthusiastic approval of engineers, constructors, and the like, to determine the strength of timbers. It is discovering how to treat cheap woods with preservatives so as to make it commercially practicable to substitute them for more expensive kinds, thus virtually adding new sources of valuable supply. It has inaugurated a new method of gathering crude turpentine which has revolutionized within a single year the naval stores industry of the United States, with an annual output of \$13,000,000 worth of turpentine and rosin, whereby the yield of turpentine is nearly doubled, with practically the same expense for labor, and the life of the tree which yields the turpentine is greatly prolonged.

In the fall of 1902 this new system had been experimentally in commercial

use for a single season on the tract of one operator in Georgia. Today the men who conduct three-fourths of the operations in the whole Southern Pine belt have adopted it, or are waiting to adopt it, as soon as their orders for the necessary apparatus can be filled.

FOREST MANAGEMENT.

While the growing willingness of the private owners, in whose hands are the great bulk of the forests of the country, to inquire into the possibilities of forestry in connection with their holdings has opened an opportunity for educational work, the value of which it is hardly possible to overstate, a larger proportion of the energies of the Bureau has been given during the past year to introducing forestry on public lands than ever before.

In accordance with the provisions of the so-called Morris Bill, selection has been made and approved of 104,159 acres out of a total of 225,000 acres of land in the Chippewa Indian reservations in northern Minnesota, which will constitute the Minnesota National Forest Reserve. Official announcement of the second selection will soon be made. Selection of ten sections to be reserved from sale and settlement has also been made and approved. Volume tables and estimates of the total stand of the forest have been prepared, upon which will be based recommendations for the reservation from lumbering of 5 per cent of the timber for seed trees, as the act provides. Trees which will not be cut when the forest is lumbered have been marked on more than 6,000 acres, and rules which will control the lumbering have been prepared and have been approved by the Secretary of the Interior.

A working plan for the tract of the United States Military Academy at West Point was prepared at the request of the Secretary of War. The forest, which consists of hardwood sprouts, is in poor condition, the result of numerous fires and injudicious cutting. The plan is accompanied by forest maps, which show the location and area of the various types of forest, and provides for fire protection and for such improvement cuttings as will again put the forest in

a sound and healthy condition. This plan is now being put into effect under the supervision of the Bureau of Forestry.

At the request of the Secretary of the Interior working plans were prepared for three Indian reservations in Wisconsin, which include recommendations for their protection from fire and rules under which they shall be lumbered without unnecessary damage to the forest.

Ninety-four applications for assistance in managing forest lands were made by private owners. Of these applications 37 were for timber tracts and 57 for woodlots. Since the Bureau put into effect its coöperative scheme of assisting private owners, applications have been received for advice in the management of 5,656,171 acres. Farmers and other private owners of small tracts of woodland throughout the Northeast, the Middle West, and the South Atlantic States have applied in increasing numbers for the assistance of the Bureau in the management of their tracts. Fifty-eight working plans for woodlots were prepared last year.

Field studies of five large timber tracts were made as follows: On 39,000 acres in Berkeley county, S. C.; on 2,321 acres on the Susquehanna River above Harrisburg, Pa.; on 16,000 acres in Mitchell, Caldwell, and Watauga counties, N. C.; on a Longleaf Pine forest in southeastern Texas, involving fieldwork on 300,000 acres, which occupied 35 men for four months, and on 125,000 acres in northwestern Maine, which occupied 32 men for three and a half months.

Working plans are in preparation for the following tracts: A forest of 25,000 acres in Sullivan county, N. H.; a forest of 50,000 acres in West Virginia, and a forest of 3,000 acres in Grafton county, N. H.

The forest of R. C. Neal, near Harrisburg, Pa., for which a working plan was prepared last year, is now under conservative forest management. Two field assistants of the Bureau are supervising the lumbering operations of a large company in Newton and Jasper counties, Texas. The working plan for the United States Military Academy at West Point is

now in operation. Twenty-seven woodlots in the Northeast and South Atlantic States are being managed in accordance with the recommendations of the Bureau. The first selection of the Minnesota National Forest Reserve, consisting of 104,459 acres, is now under the Bureau's supervision. In addition to these lands, 679,194 acres of private lands and 106,759 acres of public lands not included in forest reserves are under forest management.

The interest which large railroad companies have recently exhibited in the practice of forestry is one of the most encouraging developments of the year. Many of them have made application to the Bureau for its coöperation in studies whose results would determine the advisability of the purchase and management of forest lands for the production of railroad ties and other timbers.

Coöperative studies of state forest conditions, in which the states shared in the expense of the work, were made for Maine, New Hampshire, and California. In Maine the forests of Piscataquis county, south of Moosehead Lake, were studied. The results of the work were presented in the Fourth Report of the Forest Commissioner of that state. In New Hampshire a study of the forests of the entire state was begun, with the purpose of determining the methods by which they may best be preserved. In California the work was directed toward the making of a forest map of the state, the determination of practical modifications in lumbering methods, and of the effects of grazing and fire, and other matters entering into the determination of a state forest policy.

Studies were made of the Sugar Pine in California, the Lodgepole Pine in Montana, commercial hardwoods in West Virginia, North Carolina, Tennessee, and Kentucky, the Balsam in the Adirondacks, the Chestnut in southern Maryland, and the Red Pine in northern Minnesota.

The section of Forest Measurements, without increase of force, accomplished nearly twice as much work as in the previous year.

The work of the section of Forest Management for the ensuing year includes

more important undertakings than ever before. Technical problems involved in the management of the national forest reserves must be solved; the field work in Texas, in South Carolina, and in Alabama must be completed. Much work remains to be done on woodlots for private owners. On the lands to be included in the Minnesota National Forest Reserve those trees must be marked which are to be reserved in the lumbering, and supervision of the lumbering operations must be exercised by the Bureau. The study of the forests of California and of New Hampshire remains to be completed, and a study of Vermont forests will be undertaken. Commercial tree studies will be made in Maine, Minnesota, and the Southern States.

FOREST INVESTIGATION.

A notable accomplishment in the South during the year has been the extensive introduction of the cup and gutter system of extracting turpentine. This system, invented by Dr. Charles H. Herty, working under the Bureau's direction, although in operation only a year, is rapidly replacing the old, destructive system of boxing trees. Its great superiority is due to the fact that it is far less destructive than the box and that it yields at least 40 per cent more turpentine.

Forest investigations in 1903 were carried on in the following states:

In Maryland, a study of the distribution of the forests of St. Mary, Prince George, and Kent counties, in coöperation with the State Geological Survey.

In Texas, a study of the forest growth of the Edwards Plateau and its influence on stream flow.

In Missouri, a study of the swamp forests, including such timbers as Bald Cypress, and Red, Black, and Cotton gums.

In California, a study of the Tan-bark Oak in connection with the tan-bark industry.

In Ohio, Iowa, Michigan, and Montana, a study of forest distribution.

An investigation of the cedar-shingle industry was carried on in the Pacific northwest, which included a study of

the supplies of shingle cedar, the rate of consumption, etc.

The dendro-chemical laboratory, which was conducted in coöperation with the Bureau of Chemistry, obtained much valuable information in its study of gums and resins, the production of tannins, the use of different woods for pulp manufacture, the effects of poisonous chemicals on the life of trees, and the detection of adulterants in turpentine.

The life history of various insects harmful to trees in the East, South, and West was studied by the Division of Forest Entomology in coöperation with the Bureau. It has been estimated that insects destroy every year \$100,000,000 worth of timber. Experiments were carried on in methods of lessening this great damage.

Studies were made of the basket-willow industry and of the maple-sugar industry, and bulletins on both subjects are now in preparation.

Work in forest investigations for the ensuing year will include—

Bulletins containing descriptions of the trees of the Northeastern, Southeastern, Rocky Mountain, Southwestern, and Pacific slope regions.

An attempt to clear up the confusion in the common names of trees.

A study of forest distribution in two counties of Maryland.

Special studies of forest distribution in Missouri and Arkansas.

A study of the Big Tree of California; of the acacias of the Southwest, and of the uses, structure, and characteristics of various American timbers.

Further experiments in turpentine orcharding under the cup and gutter system, to determine the minimum wound which it is necessary to inflict on the tree, the forest conditions which make for the highest productiveness, and the like.

A forest exhibit at the World's Fair, St. Louis.

FOREST EXTENSION.

Plans for tree planting were made for 68 applicants in 29 states. These plans, which involved the examination of 40,557 acres of land, were made in accordance with the coöperative plan inaugu-

rated by the Bureau. Most of the plans were for farm woodlots of not more than 10 to 20 acres, but there were several notable exceptions. A plan was prepared for 108 acres on the Presidio Military Reservation of San Francisco. Planting plans were prepared for the grounds of the state institutions of North Dakota, at the request of Governor White. Other plans were prepared for farmers in the prairie regions along the Fort Worth and Denver City Railroad at the request of that company, and more than 600,000 trees were set out.

A planting plan was prepared for 640 acres in Cullman county, Ala., formerly covered by Longleaf and Shortleaf Pine. It was recommended that Loblolly Pine and White Oak, Post Oak, and Chestnut be planted on the land.

Men applying for planting plans show everywhere a disposition to follow the recommendations of the Bureau. Planting plans previously made are being carried out with encouraging prospects of success.

Tree planting continues on the Dismal River Forest Reserve of Nebraska and the San Gabriel Forest Reserve of California. The boundaries of the Dismal River Reserve have been surveyed and marked. Eighty acres of bottom land adjoining the reserve have been fenced, and part of the land converted into a tree nursery with space for the growing of 2,000,000 plants. Many thousands of Western Yellow Pine and Jack Pine seedlings were collected in the Black Hills and in Minnesota for planting in the Dismal River Reserve. On the San Gabriel Reserve much experimental planting was done on widely scattered areas. The planting was done mostly with pine seeds in seed spots. The total cost averaged \$7.41 per acre.

The natural reproduction of deficient forests has been studied among the hardwoods of Oklahoma, the Western Yellow Pine on the Prescott Reserve of Arizona, and the White Pine on the abandoned fields and pastures of New England.

A very important branch of the Bureau's work is the study of forest fires, with a view to discovering practicable

means of reducing the immense losses due to this cause. The year covered by the present report was characterized by fires of extraordinary severity both in the East and in the West. The great forest fires of September, 1902, in Washington and Oregon were the subject of a special investigation by the Bureau, which discovered a total loss estimated at \$12,767,100. In the Adirondacks a systematic canvass was made of the causes which brought on the extraordinary fires of May, 1903, and the damage resulting therefrom. The Bureau's investigation showed that most of the destruction was due to carelessness and might easily have been avoided. Forest fires were studied also in Georgia, Florida, and the Lake States, with a view to discovering their causes, methods of prevention, and the total amount of damage they do.

Examinations of the Atlantic Coast and Columbia River sand dunes were made in order that methods of tree planting might be discovered to restrain the encroachments of the shifting sands. Tree-planting plans for sand-dune regions on the Atlantic coast are in preparation, and a strip of sand-dune land in Oregon has been withdrawn for experiment.

Work for the ensuing year will include a continuation of coöperative work in tree planting among private owners; tree planting on Pikes Peak, Wichita, Prescott, and San Bernardino forest reserves; improvement of natural reproduction on Pikes Peak Reserve and on lands in northern New Mexico; extension of the timber belts of Kansas; a study of the methods of restocking cut-over pine lands in southern Michigan; a continuation of the study of second-growth White Pine in New England; a coöperative study with the State of California in improving the stands of timber; a study of the Eucalypts.

The suppression of forest fires and the reclamation of shifting sands will continue to receive the attention of the Bureau.

FOREST PRODUCTS.

A work of great scope and importance undertaken by the Bureau is the deter-

mination of the strength and durability of the merchantable timbers of the United States. The investigation consists of tests of timbers performed in coöperation with the Bureau of Chemistry. The work is directed toward the solution of practical problems of interest to engineers, and has been approved by many prominent engineers, manufacturers, and lumbermen. These tests are being conducted in laboratories at Washington, New Haven, Conn., and Berkeley, Cal., on Red Fir, Western Hemlock, and Longleaf and Loblolly Pine.

Wood preservation forms a most valuable feature of the work of the Bureau. Railroad companies have eagerly followed the results of this work, since it has so important a bearing on their interests. The work consists in experiments in methods of seasoning and preserving construction, railroad, and other timbers so as to increase their strength and their lasting powers. A special feature of the work which gives great promise of success is the experiments with cheap substitutes for valuable woods used for railroad ties. Such work has been done with the Lodgepole Pine in Montana, with gums, birches, and inferior oaks in Pennsylvania, Kentucky, Arkansas, and Mississippi, and with Loblolly and Shortleaf Pine in Texas. Methods of seasoning Chestnut poles were studied in coöperation with the American Telegraph and Telephone Company.

Examinations and reports dealing with technical problems in the management of forest reserves have been made for reserves in Utah, California, Oregon, and New Mexico. Twenty-nine agents of the Bureau this summer examined more than 20,000,000 acres proposed as forest reserves in the Rocky Mountain and Pacific Coast states.

FOREST RECORDS.

Extensive improvements have been made in the equipment of the forest library. Many books, pamphlets, and clippings have been added, and the whole library has been completely classified and indexed. The collection of photographs has been increased by 3,417

views, taken in 41 states and territories and in many foreign countries. The mailing list of the Bureau has increased by 75 per cent. Eighteen new publica-

tions were sent out, of which 237,000 copies were printed. Besides these, 23 press bulletins and reprints of 14 publications were issued.

RECONSTRUCTION OF THE YAKIMA VALLEY CANAL.

AN INTERESTING PRIVATE IRRIGATION ENTERPRISE IN THE STATE OF WASHINGTON.

BY

ARTHUR W. DRAKE.

THE Yakima Valley Canal Company has completed during the past summer an enlargement of the Yakima Valley Canal. In the work of this enlargement a very definite step was taken toward the use of more permanent materials and toward the conservation of water during transit from the river to the land to be irrigated.

American irrigation works are not known for their permanence; very few of them have claims to prominence from being products of the best engineering skill, but on the contrary are more often famous for being constructed of lumber, loose earth, with simple weirs and dams, all subject to decay or likely to be damaged at any time of unusually high water.

Structures of this class are not to be too severely condemned; on the contrary, their builders deserve much credit, for frequently a brush dam and the crudest of canals is all that is possible with the funds at hand. Success attained by these small structures leads to more permanent works and frequently larger canals, to irrigate more land. Gradual development through the building of small works, improving and enlarging these, and frequently by building other canals, is the most successful and permanent. Some very peculiar anomalies are met with in the West, where the best-built canals are operated with difficulty or financial loss, while the farmers' ditch, built by rule of thumb

and inefficient in many ways from an engineering standpoint, is a successful enterprise.

The improvements at Yakima have been carried out as the result of several years experience with the canal in question. The canal, known as the Yakima Valley Canal, was built in 1894, with a capacity of 37 cubic feet per second, to irrigate 3,000 acres. Water is taken from the Naches River on the south side of the stream, and for the first eight miles of its course follows along the side of a basaltic bluff. The original canal had a flume nearly eight miles long, in some places 90 feet high. This flume, in the six years of its life, has proven expensive to keep in repair. Settling of the foundation started leaks which soon would wash out great holes, engulfing large sections of the woodwork. One such place swallowed up 60 feet of the flume, and in reconstruction a truss across the soft ground was found necessary.

A portion of the canal winds around a steep, gravelly bluff, and here large quantities of water were lost and many accidents from washouts occurred, causing considerable expense, not only in repairing, but in damages paid to farmers owning land along the base of the bluff.

The increased value of land in the Yakima Valley and the consequent increase in value of water rights warranted the enlargement of the canal. So in



A VIEW OF THE CEMENT-LINED CANAL.



THE BENCH FLUME WHERE IT ENTERS THE TUNNEL.

1902 the reconstruction was commenced. The old flume was enlarged, new foundations were put in, the uprights, instead of resting upon transverse mud sills, rest upon sills parallel with the direction of the flume. A fertile source of breaks was the giving away of the foundation under one pair of uprights and the settling of enough of the trough to open a crack between the flume boards. A small stream of water thus started soon so softens the earth below the flume that nearby sills sink and further settling allows the water to flow over the side of the flume, and a serious washout follows.

The next important improvement was in the lining of the flume. Tar, liquid asphaltum, and ground lime were mixed and painted on the flume while hot. Previously the cracks between the boards were stuffed with oakum and planed battens nailed down. As a result of this treatment leakage from the flume has been reduced to a minimum.

Where the canal runs through earth in the side-hill ditches, the sides and

bottom were cement lined. The sides and bottom of the excavated canal were carefully smoothed, and board frames of the shapes of the finished canal were placed and cement packed in behind the boards. The space thus filled with cement material ranged from two to three inches in thickness. As soon as the cement had set, the boards were removed and the bottom plastered with cement and all irregularities in the sides smoothed over with a trowel.

The greater part of the distance where cement lining was put in was on a steep hillside 90 feet above the bottom. The material was mixed at the foot of the hill and pulled by horse-power up the slope on a wooden track.

The old flume went around a perpendicular rocky bluff, well known in the neighborhood as "Painted Rock," from Indian petroglyphs near the base of the bluff. This portion of the trestle flume has been replaced with a bench flume resting upon a blasted foundation and by a tunnel 60 feet long through rock. Just beyond the end of the tunnel and



VIEW SHOWING THE INVERTED SIPHON OF THE YAKIMA VALLEY CANAL.



THE SIPHON ASCENDING A HILLSIDE.

bench flume the water enters an inverted siphon consisting of two parallel red-wood pipes, one 30 and the other 32 inches in diameter.

By this system of flume, siphon, and cement-lined ditch the water does not touch earth for the first eight miles of its course, and where before 33 per cent by actual measurement was lost through seepage and evaporation, the loss is now nominal.

The cost of these improvements was about \$45,000, and will be entirely re-

covered when the 1,200 new water rights are sold.

The water delivered to each farm is measured over a Cippoletti weir, and one cubic foot per second is allowed to each 80 acres. The lands irrigated lie on and near "Nob Hill," one of the most picturesque irrigation settlements in the Yakima Valley. Alfalfa, hops, and most excellent apples are grown and give profitable returns, even with such values as \$200 to \$800 per acre on the land.

The character of the canal where it follows the bluff, the flume, tunnel, siphon, and cement-lined ditch are shown by the photographs taken in April, 1903, when water was being turned into the canal for the first time since the completion of the reconstruction.

The cementing of canals to save water and to reduce expenses from breaks has a wide importance in irrigated areas and one which is coming more prominently before the people each day. The water which is lost may be of little importance to the canal company, particularly in good seasons, when the rivers contain an abundance for all; but this water in its journey underground back to the stream courses may work excessive harm to land lying along its course

and ruin property whose owners have no redress in civil courts. This question of the damage to lands by seepage waters has been thoroughly considered by prominent engineers, and the consensus of opinion is that the water lost by seepage from canals and constantly running laterals is far more a cause of the rise of the subsoil water than is the water from over-irrigation. The loss of this water is the fault of the owners of the canal, and in justice they should be held responsible for such damage. The difficulties of proving the facts before a court have prevented many such cases being tried, and even were such decisions handed down, it is a question whether draining the damaged land would not be cheaper than the cost of a suit to recover damages.

TO SAVE THE PUBLIC LANDS.

REASONS FOR THE MOVEMENT IN THIS
DIRECTION—ONE OF THE MOST IMPOR-
TANT MATTERS NOW BEFORE CONGRESS.

BY

GUY ELLIOT MITCHELL,

EDITOR OF THE HOMEMAKER.

THERE is a reciprocal connection between the American farm and the American factory which is, of course, well understood by every manufacturer. For this reason the proposition to create some additional millions of farms and homes in the West through irrigation has met with the earnest support of eastern merchants. The support of the eastern business interests made possible the passage of the National Irrigation Act, and that act has opened up western possibilities for American factories as great or greater than occurred in the throwing open to settlement under the Homestead Act of the great and fertile Mississippi Valley. This great and prosperous agricultural area, as Secretary Wilson has said, is worth more as a market to the manufacturers of the country than all foreign lands combined,

first, because it is near at hand, and second, because we control it, and the foreign manufacturer cannot get it away from us. The same holds equally true of arid America. It is part of ourselves, and while its development, through great government irrigation works, must necessarily be slower than was that of the more eastern prairie states, yet the settlement, when it comes, will be far more dense. The average farm unit in Utah is but 27 acres, and in southern California prosperous farms can be found of 5 and 10 acres.

The work of the government in irrigation construction is something that will endure for centuries; the great dams will become parts of the eternal canyons which they wedge. The communities which their stored waters will create will be substantial, prosperous, and per-

manient. They will draw their supplies largely from the manufacturing centers of the East.

It is impossible to create new communities in the West and prevent the prosperity which they will radiate from finding its way into every channel of trade in every section of the country. Look at the matter a little in detail and see how it works out. Take one of the irrigable western valleys of, say, 100,000 acres, for which the government is now preparing to construct irrigation works. This settled up in homes averaging 100 acres each—and many of the western irrigated farms supporting families in plenty are often ten or twenty acres each—and we would have 1,000 farms with an average probably of five persons to the family. Each of these farms would have an annual consumption of \$500 worth of the products of the factory. Not considering, then, the towns and cities which would spring up, such a valley would consume a half million dollars' worth of manufactured products annually. Nearly everything of a manufactured nature which the West consumes today comes from the East, for the West is not and probably never will be much of a manufacturing section. The farm implements which the farmer uses come from the East. The wire for his fences, the staples with which he fastens it to the posts, the nails which he uses in building his house, his wagons, his clothes, and the thousand and one farm and household utensils which he uses, all come from the manufacturing centers of the Atlantic coast and the Mississippi Valley States.

There are hundreds of such valleys in the West waiting for the life-giving touch of water to convert them into prosperous farms and homes. The irrigated desert lands, rich in the accumulated stored salts and fertility of ages, yield under careful cultivation fabulous crops, and for this reason the small farm in the West takes the place of the larger acreage in the eastern agricultural sections.

The Salt River Valley in Arizona will soon be an object-lesson as to what irrigation will produce in the way of both crops and population. The great gov-

ernment dam which is now being constructed will be a wedge of rock jammed in between the precipitous sides of a narrow canyon, some 300 feet from base to curb. It will store the flood waters for an area of 200,000 acres of land surpassingly fertile. Three crops a year will result from this combination of loam, water, and a sub-tropical sunshine. The people of the Salt River valley will prosper; they will consume millions of dollars' worth of factory products every year.

The great Milk River Valley in Montana, where another government irrigation project is under way, will, when its waters are fully utilized, have over a million acres under irrigation. In a small way the new town of Hinsdale, in the Milk River Valley, affords a striking example of what results from irrigation development. A few years ago the amount of traffic handled at Hinsdale by the Great Northern Railroad was not sufficient to justify the establishment of a station; the actual receipts were less than \$50 a month. Today Hinsdale is a thriving farming colony with railroad-station earnings of over \$25,000 a year and rapidly increasing. The settlers who founded Hinsdale had but little money. The conditions were favorable for the building of a cheap canal without the necessity of storing the water. They coöperated and did the work themselves, reclaiming about 9,000 acres. They are fast becoming independent, for their land earns them annually \$25 an acre, or a total of \$225,000. There are dozens of just such instances in Montana and the other arid land states, and there will be hundreds of them, and on a much greater scale, when the government irrigation operations are fully under way.

In the West the day of the long-horn range steer, who roams undisturbed over the public domain, has passed. In his place have come improved breeds of cattle and fine sheep. This is the second stage of improvement, but it must now give way to the third. Great herds will continue always to graze upon the public land, for millions of acres of it can never be reclaimed in farms, but where water and land can

be brought together these tracts are destined to be occupied by farmers producing in a single year ten times the value of the land itself as it stands at present.

Here rises the question of the continual controversy which is going on between the stock men and the irrigators. Men in the East do not quite understand the situation—why there should be such differences—but it is easily explained. The stock-growing proposition is one thing; farming is another. Half a billion acres in the West today are free grazing lands. The stock men can run their vast herds over this land free of any charge. The land belongs to the people of the United States, but the stock men through its continued use for many years have come to consider that it belongs to them, and they are extremely jealous of the incoming farmer and irrigator, who naturally picks out the most fertile and best-watered land for his home. The big stock man cares nothing about irrigation; what he wants is ten or twenty or thirty thousand acres of land to run his immense herds upon. In recent years, however, the live stock companies and combinations have realized the changing conditions and the advance in value of good western land suitable for irrigation. While doing everything within their power to discourage settlement, they have at the same time cast about them to secure ownership of the best of the remaining public domain, and they found convenient some land laws which, when government land was apparently without limit, were slipped through Congress to enable speculators to acquire it with ease and at small expense. The outcome is that the operations of these laws have been and stand to-day a serious menace to the real development of the West—its cultivation and population.

Official and other estimates place the irrigable land of the arid region, when all the water supply possible shall have been utilized, at not over 100,000,000 acres. Last year 22,650,928 acres passed from the government into private hands, and with but a very slight increase in population. The land was not utilized

for homemaking, yet it would have made 226,509 home farms of 100 acres each. Last year the absorption of public land was almost as great, 19,488,535. It is obvious that this sort of thing should be stopped at once. The cattle men and the speculators are insistent that present conditions should continue, and that no land laws should be repealed by Congress. Naturally they are. On the other hand, it is to the interest of every man who cares anything about seeing the West grow into a thickly populated agricultural community, to every man who wants to take up a home for himself or for his children, or, on a broader plane, to every man who would see this rich heritage of the American people beneficially utilized by its real owners and their children, to see that Congress loses no time in striking from the statute books acts which are plainly there in the interest only of speculators and stock syndicates.

Irrigation and settlement are no enemies of stock raising, though they are to a certain extent of the present methods of ranging. But the production of cattle and sheep under irrigation are vastly in excess of the more general range methods of to-day. The great forage crop of the West, alfalfa, is destined to feed sheep and cattle in twenty times the number that now subsist upon the free range. Under its arid conditions this range land produces but scantily, and it takes from 15 to 30 acres to sustain one steer, whereas one acre of irrigated alfalfa will more than sustain him. In other words, a 160-acre homestead, if used for cattle growing, will produce 160 steers, as against perhaps 8 under the old conditions. Fifty thousand acres, which amount of good land may be found in the holdings of many live-stock corporations in the West, will support 2,500 head of cattle, while, if all irrigated, it would carry 50,000 head. At the same time it would support 1,560 farmers and their families, instead of a syndicate employing a few managers and a troop of cowboys.

At the last session of Congress an effort was made to repeal the Desert Land Act, the Commutation Clause of the Homestead Act, and the Timber

and Stone Act, under which enormous land frauds are being practiced, and leave upon the statute books only the old Homestead law, allowing a man 160 acres and requiring a five years' residence from him before he can secure title. Such legislation would effectually cure the carnival of land speculation and fraud now rife in the West. A bill introduced by Senator Quarles, of Wisconsin, repealing these acts, after strong opposition from the western stock interests, was reported for passage from the Public Lands Committee, but got no further. Senator Quarles has again introduced this bill, and a determined effort will be made in this Congress to awaken sufficient interest to secure its passage.

It is only a question of arousing individual interest among our people; showing every citizen of the United States that he personally has some concern in this question. He is one of our eighty million people; his share of the public domain is perhaps seven acres. Is there any reason why that seven-acre tract and other seven-acre tracts belonging to thousands of his neighbors should be unscrupulously absorbed by selfish interests, which care nothing for the de-

velopment of the West, the building up of its industries, and the equalization of its population with that of the East?

The movement to secure the repeal of these laws needs every assistance it can get, for its opponents are loth to let go of their opportunities. Their plan is now to delay matters as much as possible, offer compromises, and to suggest modifications of these laws instead of their repeal, and in the meantime do an additional work of land-grabbing during the coming year to the extent of 25,000,000 or more acres. In their ranks are able legislators, lawyers, and politicians. They are resourceful, wary, alert, and their stake is a big one. They have played with the people thus far successfully, and they are not going to let go now without exhausting every expedient.

On the other hand, the strength of the real movement lies in the fact that it is right. The foundation principle of the whole national irrigation movement is that not another acre of government land in any state, East or West, should be disposed of except to an actual settler, who will go upon a small tract of that land and found a home thereon.

FORESTRY AND IRRIGATION IN CONGRESS

BULLETIN OF NATIONAL LEGISLATIVE MEASURES RELATING TO FORESTRY, IRRIGATION, AND THE PUBLIC LANDS, FIFTY-EIGHTH CONGRESS, FIRST SESSION.

December 1, 1903.

In the Senate: Mr. Heyburn presented a memorial of the governor and legislature of Idaho, remonstrating against the establishment of the proposed Sawtooth Forest Reserve in that state.

Mr. Heyburn presented a memorial of the governor and legislature of Idaho urging legislation to determine the question whether the owners of sheep or other kinds of live stock shall be permitted to range their stock upon the several townships or other subdivisions of the public ranges by giving the right so to do according to the priority of the use of the range in such township.

Mr. Heyburn presented a petition of sundry citizens of Latah county, Idaho, remonstrating against the proposed repeal of the Timber and Stone Act.

Mr. Foster, of Washington, introduced a bill (S. 1964) providing for the continuance of the investigation relative to the strength and durability of American timbers, and making an appropriation therefor.

In the House: By Mr. Martin: A bill (H. R. 5211) to extend the provisions and benefits of an act entitled "An act for the relief of *bona fide* settlers in forest reserves, and for other purposes."

December 4.

In the House: By Mr. Williamson: A bill (H. R. 5514) to provide for the sale of the unsold part of the Umatilla Indian Reservation, and for other purposes.

December 5.

In the Senate: Mr. Ankeny presented a memorial of the legislature of Washington asking for the opening of the south half of the Colville Indian Reservation of that state to homestead entry.

Mr. Hansbrough introduced a bill (S. 2120) to amend an act entitled "An act to provide for the sale of desert lands," as amended by the act entitled "An act to repeal the timber-culture laws, and for other purposes," approved March 3, 1891.

December 7.

In the Senate: Mr. Hoar presented a petition of the National Association of Agricultural Implement and Vehicle Manufacturers, praying for the enactment of legislation to carry into effect the recommendations of President Roosevelt, in his message to Congress, on the subject of forestry and irrigation.

Mr. Burton, from the Committee on Forest Reservations and the Protection of Game, to whom was referred the bill (S. 887) for the purchase of a National Forest Reserve in the Southern Appalachian Mountains, to be known as the National Appalachian Forest Reserve, reported it without amendment, and submitted a report thereon.

Mr. Culberson introduced a bill (S. 2130) to provide for the equitable distribution of the waters of the Rio Grande between the United States of America and the United States of Mexico.

At this point the special session ended and the second or regular session began.

The President's message was read, commenting upon the removal of fences about unlawful enclosures of public lands, noting the necessity for revision of public land laws, and the progress of irrigation projects in the West, urging support for forest work and recommending that all matters pertaining to forest reserves, except those involving or pertaining to land titles, be consolidated in the Bureau of Forestry of the Department of Agriculture.

In the House: Mr. Cushman introduced a bill (H. R. 5773) making an appropriation for the administration and improvement of Mount Rainier National Park, Washington.

December 8.

In the Senate: Mr. Perkins introduced a bill (S. 2223) providing a means of acquiring a title to two groves of *Sequoia gigantea* in the State of California, with a view to making national parks thereof.

In the House: Mr. Ryan offered a resolution of the National Association of Agricultural Implement and Vehicle Manufacturers relating to irrigation of arid lands.

December 9.

In the House: By Mr. Lacey: A bill (H. R. 6480) to control grazing in forest reserves.

By Mr. Fordney: A bill (H. R. 6488) to abolish the distinction between offered and unoffered lands in certain cases.

By Mr. McGuire: A bill (H. R. 6497) for the suppression and punishment of bribery and official corruption in the territories of the United States and for other purposes.

Mr. Acheson and Mr. Dalzell each offered a resolution of the Pennsylvania State Forestry Reservation Commission relative to the preservation of the big redwood trees of California. Similar resolution offered by Mr. Brown December 17.

December 10.

In the Senate: Mr. Gallinger introduced a bill (S. 2327) for the purchase of a national forest reserve in the White Mountains, to be known as the National White Mountain Forest Reserve. A similar bill (H. R. 7284) was introduced in the House December 14 by Mr. Currier.

In the House: Mr. Adams, of Pennsylvania, Mr. Morrell, and Mr. Huff each presented a resolution of the Pennsylvania State Forestry Reservation Commission urging the preservation of the Calaveras trees of California.

December 14.

In the Senate: Mr. Warren presented a memorial of the legislature of Wyoming relative to the extension for a pe-

riod of ten years the time within which desert lands may be segregated.

In the House: By Mr. Wallace: A bill (H. R. 7295) to provide for the sale of the timber and other material growing or being on public forest reserves, and for renting or leasing of the lands therein.

Also a bill (H. R. 7296) for the protection of the public forest reserves and national parks of the United States.

December 16.

In the Senate: Mr. Nelson introduced a bill (S. 2684) to grant to the State of Minnesota certain public lands for forestry purposes.

December 17.

In the Senate: Mr. Dubois presented a resolution of the Wool Growers' Association of Idaho, treating of the relation between stock-raisers of the West and the forest reserves, and endorsing the recommendation of President Roosevelt in his last message pertinent to this subject.

Mr. Heyburn introduced a bill (S. 2722) limiting the right of selection of public lands of the United States in lieu of surrendered railroad land-grant lands.

In the House: By Mr. Lacey: A bill (H. R. 8135) for the protection of wild

animals, birds, and fish in the forest reserves of the United States.

By Mr. Williamson: A bill (H. R. 8143) to amend an act entitled "An act authorizing the citizens of Colorado, Nevada, and the territories to fell timber on the public domain."

December 19.

In the House: Mr. Mondell, from the Committee on the Public Lands, to which was referred the bill of the House (H. R. 1987), reported in lieu thereof a bill (H. R. 8460) providing for the transfer of forest reserves from the Department of the Interior to the Department of Agriculture. Said bill (H. R. 8460) was referred to the Committee on the Public Lands.

By Mr. Lamar, of Missouri: A bill (H. R. 8435) to amend the act of Congress of March 11, 1902, relating to homesteads.

By Mr. French: A memorial from the legislature of Idaho concerning the Priest River Forest Reserve.

Also a memorial from the legislature of Idaho concerning the rights of owners of live stock.

Also a memorial from the legislature of Idaho concerning a system of artesian wells in Idaho.

RECENT PUBLICATIONS.

Any of these books will be sent by the publishers of "Forestry and Irrigation," postpaid, to any address on receipt of the published price, with postage added when the price is marked "net."

The Restoration of the Ancient Irrigation Works on the Tigris, or the Re-creation of Chaldea. By Sir WILLIAM WILLCOCKS, K. C. M. G., M. I., C. E. Illustrated with maps and pen drawings on ten plates. Pp. 71. Cairo, National Printing Department, 1903.

The land of Chaldea, once the home of a world power, today is desert. The remains of irrigation works of great magnitude tell of former days when the land teemed with people, and when the valley of the Tigris was "the crown of the possessions of the powers which swayed the East." The cause of all this desolation is given by Sir William, and plans for the irrigation of the country are set forth. A plan is now on foot to send in a large party of engineers during 1904 to estimate the feasibility and cost of reclamation. This work stands before the world today as one of the greatest

now before the irrigator. The reestablishment of prosperity in a country whose history has been so glorious must be a great incentive to the engineer.

In an appendix a reprint is made of a lecture on "Egypt Fifty Years Hence." In this lecture is outlined a system of control of the Nile from its source in the Great Lakes of Central Africa to the Mediterranean—a system of control which, if carried out, will place Egypt at the forefront of the irrigated countries of the world.

Second Report of the U. S. Board on Geographic Names. Second edition. 150 pp. Government Printing Office, 1901.

In addition to the reports and recommendations of the board, this volume contains a complete list, corrected to 1900, of the geographical

names upon which they have made decisions. This board is the authority which determines the official spelling of all the puzzling and easily confounded names (in all countries) for the greater convenience of the government officials, as well as for the aid of commercial correspondence.

Water Supply and Irrigation Paper No. 81. Department of the Interior, U. S. Geological Survey. California Hydrography. By JOSEPH B. LIPPINCOTT. 478 pp., 1 map, 4 diagrams. Government Printing Office, 1903.

The purpose of this publication is to assemble under one cover all available data concerning the water supply of California. Gathered from printed records, the investigations of the Geological Survey and reports of other engineers.

The relation of rain-fall to run-off is treated by diagrams and tables and by individual discussions of nine catchment basins.

The subject of evaporation has also been investigated at five points, one of which is in Nevada.

The body of the work is taken up by discharge tables made up from observations on more than 180 rivers, creeks, and ditches.

There are also measurements of maximum floods, weir tables, and tables of rain-fall.

Report upon the Administration of the Public Works of Egypt for 1902. By Sir WILLIAM GARSTIN, G. C. M. G. Pp 476. Illustrated by photographs and colored diagrams. National Printing Department, Cairo, 1903.

This volume records the work carried on by the Ministry of Public Works in Egypt during the year 1902. It includes, besides the report of Sir William Garstin, a number of reports by the heads of the various branches of the service.

The Nile flood in 1902 was one of the lowest four within a period of 100 years, and this report is of especial interest on account of its descriptions of the measures taken by the English officers to assure a normal crop.

Water was distributed from the newly completed dam at Assuan and the barrages at Assiut and Zifta, and, although this artificial flooding was available only for a portion of the season, the results were most gratifying. The value of crops saved by the Assiut barrage alone, in one season of 1902 is conservatively estimated at \$3,000,000, while the total cost of the barrage was only a little over \$4,000,000.

Mr. A. Lucas, chemist of the Department, presents an article upon the soil and water of the Wady Tumilat. This valley, a portion of the delta of the Nile, was probably a part of the Land of Goshen, assigned to the Israelites during their sojourn in Egypt.

A few years ago a large percentage of this area was out of cultivation on account of excess of water and alkali within the soil. Drainage and washing of the soil, carried on since 1898, have so far remedied the unfavorable conditions

that all but a small acreage of the damaged lands is now profitably tilled.

The book is unusually well printed for a report of this kind and is very well illustrated.

Second Annual Report of the Reclamation Service. 1902-1903. F. H. NEWELL. Published by the U. S. Geological Survey.

This paper is a continuation of the First Annual Report of the Reclamation Service, covering the field season of 1903. The statements made in the first report are supplemented by an account of the results obtained during the past year. The latter portion of the report contains detailed descriptions of the operations in the field, in alphabetical order, by states and territories.

In his letter of transmittal to Secretary Hitchcock, Mr. Charles D. Walcott says: "There has been criticism, particularly of what appears to be slow progress in one locality or another. The idea has been held by some persons that the reclamation fund should be spent as quickly and broadly as possible to stimulate business in the West. Those who expect this have been inclined to resent the somewhat cautious way in which the work has been done and liabilities incurred. The great body of thinking people, however, are apparently satisfied with the present rate of progress, and demand that care shall be taken to prevent mistakes and guard these funds for their best use in development of the West."

Mr. Newell says: "The reclamation law in its practical application is, on the whole, not only satisfactory, but exceptionally good, more so than was anticipated when work under it was begun."

Department of the Interior. U. S. Geological Survey. Professional paper No. 11. The Clays of the United States. By HEINRICH RIES. 287 pp. Half-tones, diagrams, and colored charts. Washington, D. C.: Government Printing Office. 1903.

This is an extensive and carefully prepared treatise on the occurrence and quality of the clays of the United States, with much information concerning the industries which utilize them, such as brick and tile making.

U. S. Department of Agriculture. Division of Entomology. Circular No. 55. Powder Post Injury to Seasoned Wood Products. By A. D. HOPKINS.

Contains a description of the powder post beetle (*Lyctus planicollis*), with the nature of the wide-spread injury done by it, and recommendations for measures to be taken in preventing its propagation in lumber yards, storehouses, or other places where seasoned wood is assembled.

PUBLICATIONS RECEIVED.

Geological Survey of Michigan. Vol. IX. Part I. The Delta of the St. Clair River. By Leon J. Cole. 25 pp., 4 plates.

United States Department of Agriculture,

Office of the Secretary, Circular No. 10. Standards of Purity for Food Products.

U. S. Department of Agriculture, Office of Experiment Stations, Circular No. 53. Report of the Committee on Rural Engineering of the Association of American Agricultural Colleges and Experiment Stations.

New York Agricultural Experiment Station, Bulletin No. 240. Inspection of Feeding Stuffs. By W. H. Jordan and F. D. Fuller. Geneva, N. Y.: Published by the Station. September, 1903.

Water Supply and Irrigation Paper No. 78. Department of the Interior. U. S. Geological Survey. A Preliminary Report on Artesian Basins in Southwestern Idaho and Southeastern Oregon. By Israel C. Russell. Charts and diagrams. 49 pp. Government Printing Office, 1903.

Water Supply and Irrigation Paper No. 79. Department of the Interior. U. S. Geological Survey. Normal and Polluted Waters in Northeastern United States. By Marshall O. Leighton. Diagrams. 186 pp. Government Printing Office, 1903.

Water Supply and Irrigation Paper No. 80. Department of the Interior. U. S. Geological Survey. The Relation of Rainfall to Run-off. By George W. Rafter. Diagrams. 102 pp. Government Printing Office, 1903.

Water Supply and Irrigation Paper No. 77. Department of the Interior. U. S. Geological Survey. The Water Resources of Molokai, Hawaiian Islands. By Waldemar Lindgren. Cuts and diagrams. 60 pp. Government Printing Office, 1903.

U. S. Department of Agriculture, Bureau of Soils, Bulletin No. 21. Reclamation of Alkali Lands in Egypt as Adapted to Similar Work in the United States. By Thomas H. Means. Cuts and diagrams. 48 pp. Government Printing Office, 1903.

Farmers' Bulletin No. 181. Department of Agriculture. Pruning. By L. C. Corbett. 39 pp. Cuts. Government Printing Office, 1903.

Crops used in Reclamation of Alkali Lands in Egypt. By Thos. H. Kearney and Thos. H. Means. (Reprint from Year Book of Department of Agriculture for 1902.)

Circular No. 10. Bureau of Soils. The Use of Alkaline and Saline Waters in Irrigation. By Thos. H. Means. 4 pp.

Circular No. 11. Bureau of Soils. Reclamation of Alkali Land at Fresno, Cal. By Thos. H. Means and W. H. Heileman. 9 pp.

NEW MEMBERS OF THE AMERICAN FORESTRY ASSOCIATION.

The following-named persons have joined the American Forestry Association since our last issue:

Bickford Co., The H. M., box 2876, Boston, Mass.

Bruner, Lawrence, University of Nebraska, Lincoln, Neb.

Calhoun, John E., Cornwall, Conn.

Cannon, W. A., Tucson, Ariz.

Chase, Josiah, York Corner, Maine.

Cole, Frederick W., 29 Broadway, New York city.

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Harper, J. C., St. Paul bldg., Cincinnati, Ohio.

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Holliday, W. H., Laramie, Wyo.

Holstein, H. L., Kohala, H. T.

Houghton, Miss E. H., 58 Garden st., Cambridge, Mass.

Koch, E., Bureau of Forestry, Washington, D. C.

Lehman, Walter, Lewistown, Mont.

Longfellow, Miss A. M., 105 Brattle st., Cambridge, Mass.

McConnell, I. W., Montrose, Colo.

Mann, Matthew D. (M. D.), 37 Allen st., Buffalo, N. Y.

Marcou, John B., Princeton, Mass.

Moen, Philip W., Worcester, Mass.

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Richards, Bartlett, Ellsworth, Neb.

Robinson-Edwards Lumber Co., The, Burlington, Vt.

Sterrett, Wm. D., Station E, Washington, D. C.

Stimson, Miss Margaret, 11 West 17th st., New York city.

Traver, W. H., Hudson, N. Y.

Walker, F. H., 850 Jefferson ave., Detroit, Mich.

PUBLISHER'S NOTES.

That advertisers find FORESTRY AND IRRIGATION a paying medium for their announcements is shown by the steady growth the magazine is having in this direction. In this number several new advertisements of reliable firms appear for the first time.

There is a widely growing demand for mathematical and surveying instruments and other supplies for forest work. We therefore take satisfaction in calling attention to the advertisement of Keuffel & Esser, which appears on another page of this issue. This firm was established in 1867, and we are able to recommend them highly as dealers in general supplies for forest work. Those of our readers who are in need of articles in this line will do well to communicate with them. Keuffel & Esser are both manufacturers and importers, and they furnish many supplies for the U. S. Bureau of Forestry.

As the time for purchasing nursery stock of various kinds is again at hand, we wish to call attention to the advertisements we have been carrying of reliable firms, and to the new announcements this month of Carl Sonderegger, of Beatrice, Neb., under the head of "Trees that Grow," and also that of J. A. Gage, another well-known nurseryman of Beatrice.

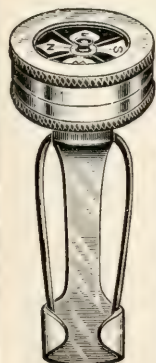
The Reliable Wholesale Opticians of Muskegon, Mich., who furnish excellent references as to their responsibility, are among our new advertisers in this number.

The advertisement of C. Howland, entitled 7 %, is a high-grade business proposition, which we were satisfied about before accepting the announcement.

To any one wishing to rent a winter home, fully furnished, in the most equable climate of any section of the United States, they can be put in touch with the owner by addressing this office. Possession of this property can be given immediately. See advertisement in this number.

Special attention is called to the announcement of John Sherman & Co., which appears for the first time. We are able to recommend this firm highly for their activity and fair dealing in real-estate investments. They are making a specialty of timber and mineral lands, and are advertising a number of high-grade propositions which should be of interest to many of the readers of FORESTRY AND IRRIGATION.

In looking for articles needed in hunting, fishing, and camping, readers should communicate with the Marble Safety Axe Co., Gladstone, Mich., who manufacture an unusually serviceable line of such goods, well known among the sporting fraternity at large.



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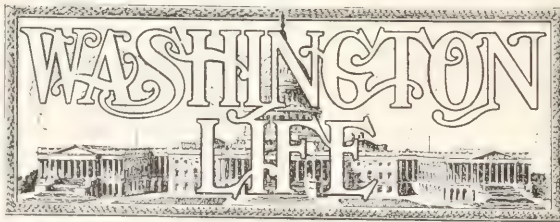
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FOREST FABLES.

WOODLAND TALES WHICH SMACK OF BARON MUNCHAUSEN.

IN the last issue of FORESTRY AND IRRIGATION we called attention to some stories which are going the rounds of the press as Simon-pure news, but when dissected, even by the most casual observer, will not pass muster either as news or truth. In spite of this, however, reputable journals give credence and circulation to these yarns, seemingly without any investigation whatever; and, even at the risk of spoiling one's faith in the veracity of the press, we call attention to a couple more which have had a long run before the market.

THE BARN THAT ROSE.

Many of our readers who have lived in the rural districts, especially about a decade or so ago, realize the full significance of a barn-raising, where all the neighbors come to help erect the timbers of a new barn, and the occasion is one of great social as well as industrial interest. But the raising chronicled in a fugitive paragraph, which has not yet been nailed, as far as we know, is of quite a different sort. An imaginative writer exemplifies the saying that "a little knowledge is a dangerous thing" by taking the fact that willow logs will sprout and grow in moist ground, even after they have been cut from the tree for some space of time, as the basis for a clever story which hails from Iowa. In this case a man made the corner posts of his barn of willow timbers, which he cut and planted in the earth to insure the stability of the structure. The well-known habit of the Willow, aided and abetted by a wet season, resulted in the astonishing phenomenon of having the corner posts grow rapidly, thereby raising the barn some inches from the ground, and, in fact, so rapid was the growth that at last accounts the farm animals found shelter beneath the raised floor of the marvelous barn. It sounds very good and is certainly circumstantially based. But one who knows anything about the growth of trees must know that their increase in height comes altogether from additional growth at the top and not at the bottom; that a scar on the trunk of a tree four feet from the ground will remain at that height, no matter how long or how tall the tree may grow. If this were not so we would expect to see "blazes" on the trunk of a tree, to indicate a trail or a boundary, clear up among the topmost branches in the course of time, out of reach and out of sight. Unfortunately for the veracity of the barn story, the persons who put such marks on tree trunks do so with some idea of permanency, and have not been disappointed, in countless years of the practice, by finding that their memoranda grow beyond future recognition.

But the barn story has been going for some time, and it will be quite a while before it is

flagged. The farmer who owns the barn is waiting for only one more year's growth to double the capacity of his building, for by that time he will have the simple task of boarding up the lower part of the structure and putting it to use; and, as Kipling has so frequently and aptly stated, "that will be another story."

TO RID LAND OF STUMPS.

An imaginative hack writer, who syndicates his stuff, and therefore gives it wide circulation, and who has headquarters in Washington, so that the esteemed *Star* of that city prints his material, has evolved from a fertile brain a solution of the great difficulty of clearing land—the task of removing the stumps. It is preferable to give him credit for the invention, though it seems quite as likely that some shrewd old village wit put up a game on "one o' them lit'ry fellers" and told the yarn which the sedate old *Star* and other papers subsequently vouched for. The burden of the tale, which appeared in an article on raising cranberries, told the way in which cranberry meadows were cleared of timber, and is about as follows: After the trees are cut and everything removed save the stumps, the land, which must be low, is diked, with an outlet at one end, and flooded. When freezing weather comes, the water freezes fast to the stumps. More water is let in, raising the level of the pond. The stumps are pulled up by the tremendous upward pressure, and when a thaw comes they are floated toward the outlet and carted off. Sounds easy, doesn't it? The difficulty here is one of hydraulics rather than forestry, but since it is a forestal operation it comes properly in this column. Let us suppose that the pond is frozen so tight that the ice adheres to the stumps and the shore, so that the added water can not get through any interstices when it rises. This must be so, else it would not raise the whole ice sheet; nor would it raise the stumps with it. Then, how does the added water get under the ice, and why does it not freeze on top, the ice sheet being water-tight? Or if there is room for the water to get underneath, it can not be fast to the stumps; or if the pond is frozen solid to the bottom, where does the extra water go when it is flowed in? In plain words, it won't work, and the story is a pretty variation of the one in which the flock of ducks settled on a pond and had their feet frozen fast. When they were frightened they rose in the air, carrying the pond with them and leaving the poor fish to gasp out their lives in the shallow pools which were left; and yet, as the files of the usually reliable Washington *Evening Star* will show, that story appeared therein last November as a matter of genuine news.

NOTICE. The Real Estate Department of FORESTRY AND IRRIGATION having become too extensive to be properly handled as heretofore, has been transferred to the firm of JOHN SHERMAN & COMPANY, of Washington, D. C., whom we commend to our patrons with the assurance that the same favorable treatment and fair dealing accorded by us will be continued by the firm named.

Mr. John Sherman, the senior member of the firm, is well and favorably known in Washington, and therefore needs no introduction in this neighborhood. To our readers in other parts of the country we would say that they will find his reputation, after a business life of thirty years in this community, to be of the very best; wherever he is known his name standing for honesty and integrity.

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Timber and Mineral Lands in All Parts of U. S.

SOUTHERN PINE AND CYPRESS LANDS A SPECIALTY

REFERENCES: ANY BANK OR TRUST COMPANY IN WASHINGTON, D. C.

HAVING succeeded to the Real Estate Department of FORESTRY AND IRRIGATION, we place our services at the disposal of all who may care to take advantage of them, either in the purchase or sale of timber or mineral lands. We have excellent facilities for conducting such business, and promise careful attention to all matters entrusted to us.

We make no charge for any services rendered unless a sale results from our efforts, at which time the compensation agreed upon when the property is placed in our hands will be expected.

We will accept under the conditions here given first-class properties and advertise them in public print and in our booklets and otherwise, absolutely without cost to our customers, except as above stated.

Descriptions of properties must be given accurately and in detail, it being understood that they must stand a thorough examination.

The property to be placed in our hands only by the owner or duly authorized agent, who has authority to make negotiations for sale.

Under no circumstances will we knowingly accept property that is inflated in value or upon which an additional price has been placed over that asked in the vicinity where located, or to other customers.

The commission or compensation to us is to be paid only in the event of sale through our efforts, such compensation to be agreed upon in advance and a contract properly covering the same to be given us.

When property is placed in our hands for sale we shall ask a reasonable time in which to accomplish sale and a reasonable option on property when a customer is secured who desires time for inspection and examination of title.

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A splendid opportunity for milling enterprise; 5,000 acres of choice timber lands, in solid body, located on both sides of the Black Warrior River and adjacent to railroad, near Demopolis, Ala. The timber consists of White Oak, Red Oak, Hickory, Poplar, Ash, Cypress, Gum, and Longleaf Pine, Oak predominating. Will cut 30,000,000 feet. Will sell timber under 10-year removal contract. Excellent location for saw-mill; easy and cheap transportation. Complete details on application.

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CALIFORNIA

CALIFORNIA TIMBER

GROUP A.—5,000 acres sugar and yellow pine in Eldorado county; will cut 45,000 feet per acre. **\$20 per acre.**

GROUP B.—2,000 acres yellow pine in Eldorado county; will cut 25,000 feet per acre, and 4,000 cords of wood on tract in addition; when cleared, the best deciduous fruit lands in the state. **Only \$6 per acre.**

GROUP C.—4,640 acres of redwood in Mendocino county, on line of railroad; will cut 40,000 feet per acre; also Oregon pine, not estimated. **\$20 per acre.**

GROUP D.—22,000 acres of redwood timber in Mendocino county; more than 400,000,000 feet now standing; railway to shipping point on ocean; this proposition includes mills in operation; capacity, 100,000 feet per day; net profits alleged to be \$75,000 to \$100,000 per annum. **Bargain at \$450,000.**

GROUP E.—12,000 acres redwood on Garcia River, Mendocino county; mill site and landing on ocean; will cut 40,000 feet per acre. **Price, \$25 per acre.**

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64,000 acres; average cut, 2,000 feet of pine to the acre. These lands lie in the noted lemon, orange, and vegetable belt of the state, and have transportation facilities by both rail and water.

FLORIDA—Continued

90,000 acres; this tract contains 70,000 acres of Longleaf Pine and 20,000 acres of Cypress. The timber is estimated to cut from 2,000 to 3,000 feet per acre. A large saw-mill costing \$40,000 is located on this land and is included in the sale of the land and timber. This mill is located on a river to which a great deal of this tract is contiguous.

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95,000 acres of coal and timber land, in Pike county, Kentucky.

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SOUTH CAROLINA—Continued

GROUP B.—22,000 acres, estimated to cut 80,000,000 feet of choice cypress, 70,000,000 choice short-leaf North Carolina pine, balance of timber oak, ash, hickory, sycamore, gum, etc. **\$1.50 per thousand.**

GROUP C.—14,000 acres, estimated to cut 30,000,000 feet of choice cypress, 15,000,000 of oak, 15,000,000 short-leaf pine, 8,000,000 cottonwood, 10,000,000 ash, balance hickory, sycamore, elm, gum, etc. **\$1.00 per thousand.**

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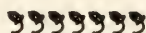
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2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.

3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.

4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.

5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.

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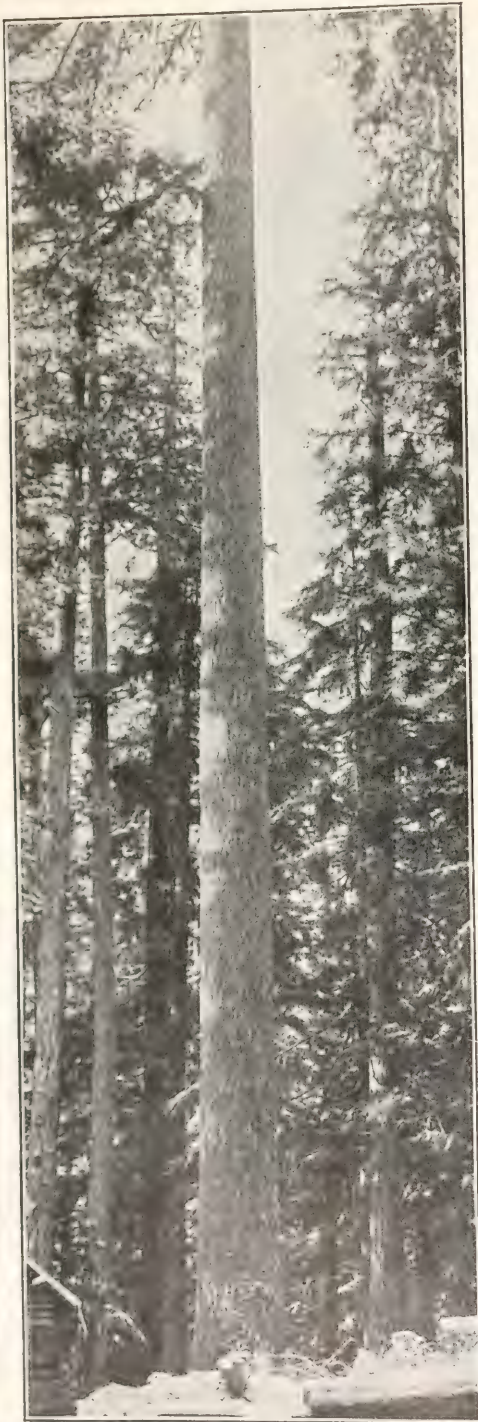
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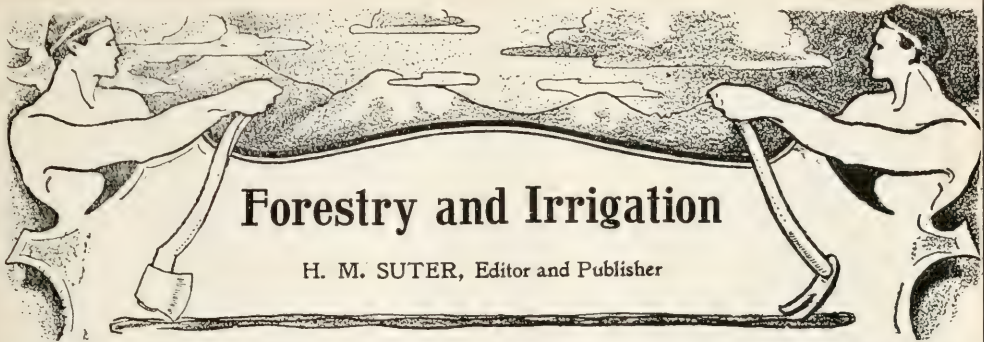
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Forestry and Irrigation

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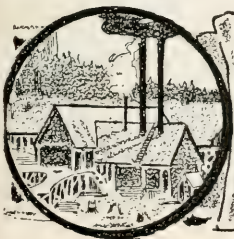
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INTERIOR OF A BLUE GUM GROVE IN CALIFORNIA.

Forestry and Irrigation.

VOL. X.

FEBRUARY, 1904.

No. 2.

NEWS AND NOTES.

Important Conventions of Stockmen.

The conventions of the National Livestock Association and of the National Woolgrowers' Association were held simultaneously at Portland, Oregon, January 11 to 15.

Mr. Gifford Pinchot, Forester, U. S. Department of Agriculture, and Mr. F. H. Newell, Chief Engineer U. S. Reclamation Service, both members of the recently appointed Commission on Public Lands, attended the conventions at the direction of President Roosevelt, in order to attain the closest possible touch with the sentiment and attitude of the grazing interests toward the proposed revision of the public-land laws, the forest reserves, and the reclamation projects.

The Livestock Association had on its program three questions for discussion, one of which was the desirability of forest reserves. The Woolgrowers' Association also had three questions for discussion, one of which was the desirability of change in the land laws. Usually the business was transacted during the morning in separate session, and in the afternoon the two associations met jointly at the invitation of one or the other.

The general subject of forest reserves in relation to the range-sheep industry was threshed over by a number of brief addresses explaining existing conditions in various states and territories, and followed by discussion. The attitude of the delegates to the conventions developed as follows:

First. Strong approval of the forest-reserve policy of the government under the principles laid down, shown in the resolutions in the next note:

Second. The recognition that the stock industry must be protected against in-

jurious competition, or the ranges will be destroyed.

Third. A general desire among the stockmen to have the government take control of the summer range.

A special meeting of representative delegates to the National Livestock and National Woolgrowers' conventions to discuss the range question was held at the Portland Hotel, Portland, Oregon, Wednesday, January 13, for the discussion of public-land questions for the information of the Commission on the Public Lands. Owing to Mr. Newell's illness, Mr. Pinchot only was present. The following representatives of the livestock interests were in attendance: Arizona—E. S. Gosney, C. C. Hutchinson, and F. B. Mason; California—H. A. Jastro; Colorado—M. K. Parsons and Fred P. Johnson; Idaho—L. L. Ormsby, H. J. Hagenbarth, Monte B. Gwinn, F. W. Gooding, J. C. Pierce, and Ed. Payne; Utah—Hon. Jesse M. Smith, J. H. Seeley, W. D. Campbell, and F. J. Jansen; Oregon—Douglas Belts and W. H. Roper; Washington—Mr. Benson, John Cleman, and R. K. Nichols; Wyoming—B. B. Brooks and Timothy Kinney; New Mexico—Represented by H. A. Jastro.

Mr. H. A. Jastro, of California, was made chairman and Mr. Fred P. Johnson, of Colorado, secretary of the meeting.

After a general discussion, upon motion of Mr. B. B. Brooks, of Wyoming, it was the sense of the meeting that the bill now pending in Congress for the transfer of the forest reserves to the Agricultural Department ought to be passed at once.

It was the sense of the meeting that all local questions affecting the range should be decided upon local grounds.

Toward the end of the meeting Mr. Pinchot asked the following question: "If local questions can be decided upon local grounds, and if it is possible to devise satisfactory rules and regulations, is this meeting in favor of government control of the summer range?" By a show of hands, all persons present, with the exception of B. B. Brooks, of Wyoming, voted in the affirmative. Mr. Brooks preferred state control.

On the return trip from Portland to Washington Mr. Pinchot and Mr. Newell made stops at Sacramento, Reno, Salt Lake City, Denver, and Cheyenne to consult with the Governors, State Land Boards, and representative citizens concerning the operation of the public land laws in their states, the proposed repeal of certain of them, and the measures required to promote settlement and the building of homes.



Resolutions by Woolgrowers. The following are the resolutions, alluded to in the foregoing note, which were adopted by the National Woolgrowers' Association at their convention in Portland:

Whereas a bill has been introduced in the House of Representatives (H. R. 1987) providing for the transfer of the National Forest Reserves from the Department of the Interior to the Department of Agriculture; and

Whereas this transfer is strongly recommended by the President, the Secretary of the Interior, the Secretary of Agriculture, and the Commissioner of the General Land Office; and

Whereas the Department of Agriculture, from its practical knowledge of actual conditions on forest reserves, is well fitted to protect and utilize their various resources; and

Whereas the investigations of the Department of Agriculture into questions of grazing have been marked by intelligence, fairness, and a thorough understanding of business requirements; and

Whereas the sum heretofore appropriated by Congress for the administration of the forest reserves has been insufficient to afford a business-like management; and

Whereas the forest-reserve policy is now beyond the experimental state, and has become a fixed part of the policy of our government: Now, therefore, be it

Resolved, That the transfer of the forest reserves from the Department of the Interior to the Department of Agriculture is to the direct interest of the National Woolgrowers' Association; and be it further

Resolved, That this association, through the representatives of its members, urges the enactment of this bill by Congress; and be it further

Resolved, That the appropriation for the forest reserves be made ample to insure a thorough, practical, and business-like administration, in proportion to the magnitude of the interests involved. Be it further

Resolved, That these resolutions be transmitted by wire by this association to Honorable James Cannon, the Speaker of the House of Representatives, and to Senator Frye, President of the Senate.

WOOLGROWERS TO PRESIDENT.

Whereas The National Woolgrowers' Association of the United States realizes the great debt of gratitude which the livestock interests of the United States, especially in the inter-mountain regions, owes to the Honorable Theodore Roosevelt, President of the United States; the Honorable James Wilson, Secretary of Agriculture; the Honorable Gifford Pinchot, Chief of the Bureau of Forestry, and the Honorable F. H. Newell, of the Geological Survey, for their interest in and study of the livestock conditions, and for their efforts to better the same, both in the field and on the range; now, therefore, be it

Resolved, That the National Woolgrowers' Association, in convention assembled, at Portland, Oregon, hereby extends its grateful acknowledgments and thanks to our President, Honorable Theodore Roosevelt, for sending to this convention the Honorable Gifford Pinchot and the Honorable F. H. Newell; for the expressions of good will and interest conveyed to us through these representatives of two branches of the government service in which we are

directly interested, and to the Honorable James Wilson, Secretary of Agriculture, for the interest and good will he always displayed toward our industry.



Geological Survey Flag. The Coast and Geodetic Survey and other scientific bureaus of the government have special flags, which their men carry wherever their assignments lead them and fly above their camps in the wilderness.

The Geological Survey has recently adopted a special signal of this kind from a design by Mr. Robert Hollister Chapman, which shows, in white, a triangle crossed by two hammers and surrounded by a circle of thirteen stars, on a rectangular flag of dark blue.

The new signal was displayed January 15 for the first time, hoisted beneath the federal ensign on the staff above the Survey offices at F and Fourteenth streets, Washington.



Reclamation Engineers Meet. An important meeting of a number of the leading engineers of the

U. S. Reclamation Service was held at the Geological Survey, Washington, D. C., during the last week of January. This conference was for the purpose of giving consideration to the plans for a number of important irrigation projects before passing them up to the Secretary for final decision.

Those present were: Chas. D. Walcott, Director of the Geological Survey; F. H. Newell, chief engineer of the Reclamation Service; A. P. Davis, supervising engineer, Arizona district; J. B. Lipincott, supervising engineer, California; A. L. Fellows, district engineer, Colorado district; C. H. Fitch, South Dakota; E. M. Taylor, engineer, Nevada district; M. Bien, legal adviser, Washington, D. C.; C. C. Babb, engineer, Montana district; F. E. Weymouth, district engineer, North Dakota district; J. Ahern, district engineer, Wyoming district; J. T. Whistler, district engineer, Oregon district; H. A. Stores, electrical expert; M. C. Hinderlinder, hydrographer, Colorado district;

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The engineers also visited the White House in a body, where they were introduced to President Roosevelt.



Cass Lake Timber Sales. On December 5, 1903, and also on December 28, sales of the pine stumpage selected under the provisions of the Morris act were carried on at Cass Lake, Minnesota. The results were most gratifying, both as regards the actual success of the sale and the inference, which can hardly be avoided, that lumbermen are beginning to concede that their work can be done at a profit under the principles of forestry.

As has already been stated in these columns, the Morris act requires that the timber shall be removed from these lands within the next four and one-half logging seasons, leaving 5 per cent of selected seed trees for the production of a new stand. All tops and litter under 8 inches diameter resulting from the prospective logging must be burned and care taken in felling to avoid crushing young growth.

It has been supposed by many that these conditions and others imposed upon the lumbermen would militate against the success of the sales, but such was not the case.

Over 300 sealed bids from 14 bidders were opened at the first sale. About 213,000,000 feet of White and Norway Pine were sold at an average of \$7 per thousand, the highest price heretofore obtained for such timber in Minnesota and at least \$3 per thousand higher than had been anticipated by the offi-

cials of the Interior Department. The total amount of the bids for this timber was \$1,432,772, of which \$1,205,000 was accepted from two companies of the Weyerhaeuser Syndicate.

At the second sale, on December 28, there was a determined contest on the part of nearly a dozen companies for possession of the desired sections, and 183,000,000 feet were sold, which is 30,000,000 less than on the 5th; but the stumpage brought about \$25,000 more than the previous sale. The highest bid made was by a branch of the Weyerhaeuser Syndicate—\$12.35 for White Pine and \$10.35 for Norway.

In general, the increase was from 75 cents to \$1 per thousand over the bids of the first sale. The highest bid was 35 cents more than the highest on December 5.

The further progress and success of the operations on these lands will be a matter of interest to American foresters.



Vermont Forestry Association. January 6, at Burlington, Vermont; Mr. Pinchot met and addressed a body of men interested in forestry, agriculture, and the work of the State Experiment Station. As a result of this meeting the Forestry Association of Vermont was organized, with the following officers:

President, W. J. Van Patten, Burlington; Vice-Presidents, E. C. Smith, St. Albans; George Aitkin, Woodstock; Secretary and Treasurer, Ernest Hitchcock, Pittsford.

The following members, with the above-named officers, form the Executive Committee: Charles H. Green, White River Junction; Joseph A. De Boer, Montpelier; Joseph Battell, Middlebury.

January 19 the new association held its first general meeting, and its interest was quickened by an address by Prof. Graves, of the Yale Forest School.

The gathering was also addressed by Mr. C. H. Green, of the International Paper Company, a strong advocate of conservative forest management, who gave some points of practical experience.

Eastern Business Interests Favor Irrigation.

The Western land looters are considerably disturbed over the action of eastern commercial bodies on the irrigation and land questions. They recognize probably that the influence of the eastern factory and merchant was largely felt in the passage of the National Irrigation Act, and that well-considered resolutions such as were recently passed by the National Board of Trade and the Merchants' Association of New York can not be without their effect. This latter organization, comprising the principal business houses of New York, has made during the past six months a special study of the questions of irrigation and forestry and their relations to manufacturing and the sales of factory products. The report brought in at their annual meeting by a special committee on irrigation and forestry decided the association to lend its active support to the movements, and as a first measure to enter the campaign for the repeal of the three land laws, the Desert Land Law, the Timber and Stone Law, and the commutation clause of the Homestead Act, which are in conflict with the National Irrigation Act.

Mr. Charles B. Boothe, of The National Irrigation Association, made the New York merchants an interesting address. He said in part:

"The beginning of our civilization was in irrigated countries, and the scenes depicted in the Old and New Testaments have their setting among the wonders of irrigation. India, China, Egypt, no less than Greece and Rome, developed to their highest attainments with irrigation as the basis of their prosperity.

"All the great kings and warriors in ancient history ruled over irrigated countries. Take irrigation from our history and we have left only the records of barbarism. Out of irrigation have come Christianity and the inspiration of today.

"In our own land irrigation has put into southern California nearly half a million people, with less than 250,000 acres of land reclaimed, and in the Valley of the Colorado, lying between California and Arizona, a million and a

half acres of land, as rich as the Valley of the Nile, await to be reclaimed.

"Markets are being sought for the world over. Extension of trade is the cry of the hour. Compare the annual expenditure of the average family in the United States with the yearly expenditure in those countries which are now being exploited by our commercial agents, such as Central America, South America, the Philippines, China, and Japan. During a recent visit to the last-named country the Minister of Agriculture informed me that, taking an average family of five, the annual expenditure was estimated at 300 yen, or about \$150, of which more than two-thirds was for food. Those who have given any attention to the purchasing power of the family in our country will need but little argument to be convinced that the value of our home market is not even approached by that of any other section of the globe."



Wood-Coal. Mr. A. A. Low, the owner of an extensive tract of woodland and a handsome camp

at Horseshoe Pond, in the Adirondacks, has devised and installed steam-driven machinery for the purpose of preparing fuel in an economical way from tops, dead and down wood, and trees removed from the forest in thinning or otherwise.

The wood is fed between toothed rollers, which force it against knives revolving at a high rate of speed. The cut wood is delivered in fragments from twice the size of a man's fist down to splinters and shavings. In this form it dries easily and quickly, and is convenient for handling and feeding fires. As a test of the efficiency of the machine, a Fir tree 30 feet long and 9 inches through the butt was reduced to "wood-coal" (as Mr. Low names his product) in a few seconds, being fed through the rolls butt first, top and all.

The wood-coal is packed in sacks. Mr. Low thinks of placing it upon the city markets as a fuel. A plentiful supply last winter would have been a boon, but it seems extremely doubtful, considering the item of transportation and the ordinary grates in use, if it can ever compete with coal on account of the greater fuel value of the latter.



THE MACHINE WHICH PREPARES WOOD-COAL AT A. A. LOW'S CAMP IN THE ADIRONDACKS.

Forest Reserve Personals.

Inspector Charlton has returned to Washington after a trip of inspection through the federal forest reserves. He will resume his work in the field soon.

John H. Ruff, who has been connected with the Yellowstone Reserve in Wyoming for the past few years, has tendered his resignation to the Department of the Interior.

Ranger R. S. Baldwin, of the eastern division of the Santa Barbara Forest Reserve, stopped a few days in Washington recently, while on his way to New Haven, Conn., where he will take a course in forestry at the Yale Forest School.

Forest Supervisor R. S. Lambert, of the western division of the Washington Reserve, has tendered his resignation.

Morris P. Watson has been promoted from ranger to supervisor, and has been placed in charge of the Santa Rita and Santa Catalina Reserves, in Arizona.

Forest Supervisor W. H. Pearce, of the Shoshone division of the Yellowstone Reserve, in Wyoming, has returned from Europe and resumed his duties.

Ranger Louis F. Kneipp, of the Prescott Reserve, Arizona, has been given temporary charge of the Pecos River Reserve, in New Mexico.

The Pine Mountain and Zaca Lake and the Santa Ynez Forest Reserves, in California, have been consolidated, including a portion of the intervening territory near their western limits. The resulting reserve will be known as the Santa Barbara Forest Reserve. Forest Supervisor W. M. Slosson will have charge of the eastern division and Forest Supervisor B. F. Crawshaw of the western division of the new reserve.

Forest Supervisor Henry Michelsen, of the Pike's Peak group of reserves, Colorado, has returned to duty after a long leave of absence on account of ill health.

The Crow Creek Forest Reserve, in Wyoming, has been turned over to the War Department as a military reservation.

Mr. E. A. Sherman has been appointed Forest Supervisor of the Bitter Root, Montana, Forest Reserve.

The Lewis and Clarke and the Flat-

head Reserves, in Montana, have been consolidated under the name of the former. The small strip of territory between the two is included in the new reserve. Supervisor F. N. Haynes will have charge of the northern division and Supervisor Gus. Moser of the southern.

Forest Supervisor Percy H. Farley, who formerly had charge of the eastern division of the Washington Reserve, died December 8, 1903. Superintendent Scheller has taken temporary charge of his work.

Canadian Forestry Association to Meet.

The fifth annual meeting of the Canadian Forestry Association will be held in Toronto, Ontario, on Thursday and Friday, the 10th and 11th of March, 1904, and all persons interested in the preservation of the forests are invited to be present.

Papers on very important subjects in forestry will be read and discussed, and on the evening of the 10th a banquet will be held at the King Edward VII Hotel, which will afford opportunity for the closer acquaintance of those who attend the convention.

Yale Forest School.

The work of the Forest School is proceeding regularly at New Haven, in Marsh Hall, which was recently burned and refitted throughout. The fire interrupted the school routine for only one week, and the reconstruction of the building has allowed of greater convenience of arrangement than was formerly possible.

Philippine Bureau Needs Foresters.

There are at present a number of vacancies in the different grades of the Bureau of Forestry in the Philippines, and good men are needed for this important work.

Examinations for these places will be held in different parts of the United States about March 1, July 1, and November 1.

The salaries of foresters, assistant foresters, inspectors, and assistant in-

spectors range from \$1,200 to \$2,400 per year. Actual necessary traveling expenses to and from the scene of field work are defrayed by the government, and while in the field one dollar (gold) per day is allowed for subsistence.

The reports, bulletins, and other publications of the Philippine Bureau of Forestry should be read by all desiring to enter the service. Copies may be obtained from this Bureau at Manila, P. I. For detailed information in regard to the date of examinations and related matters, address the Bureau of Forestry, Washington, D. C.

Copies of the Philippine Civil Service Manual may be obtained from the Bureau of Insular Affairs, War Department, Washington, D. C.



Results of Woodlot Management. George H. Whiting, writing from Yankton, South Dakota, says:

"I have logs enough cut now to make 40,000 to 50,000 feet of lumber, which will be sawed before next spring.

"These logs I cut from a 10-acre grove that was only a brush patch 13 years ago when I came onto the place.

"In addition to the logs, the grove has supplied plenty of wood for two to four stoves, and some for sale, besides posts and poles, all of which came from the thinnings.

"There are still trees enough left on the land to make a good grove."



Withdrawn Lands Restored to Settlement. On January 20, 1904, by direction of the Secretary of the Interior, the Acting Commissioner of the General Land Office restored to settlement and entry the public lands within an aggregate area of 358,000 acres in the Eureka, Redding, Susanville, and Stockton land districts, in California.

The lands so restored to settlement and entry constitute a part of an aggregate area of 7,800,000 acres, in California, included within the boundaries followed in making temporary withdrawals directed by the President and by the Secretary of the Interior, within the

past two years, for proposed forest reserves, following requests embodied in public petitions and recommendations made by the Department of Agriculture and the United States Geological Survey.

The object of these withdrawals was to prevent the initiation of further claims on the lands, pending a thorough examination of the withdrawn areas by practical and experienced agents of the Bureau of Forestry, with a view to determining as to what portions of the withdrawn areas should be permanently reserved for forest purposes and what portions should be restored to settlement and entry as being more valuable for agricultural purposes than for use as forest reserves.

The restoration just made, which covers parts of the proposed Klamath River, Mt. Shasta, Lassen Peak, and Feather River Forest Reserves, temporarily withdrawn on October 17 and 22 and December 24, 1902, and September 30 and October 1, 1903, was recommended by the Secretary of Agriculture as a result of the field examinations made by agents of the Bureau of Forestry during the season of 1903, and in his recommendation the Secretary of Agriculture calls particular attention to the fact that this restoration must not be understood to embrace *all* the lands in California now under temporary withdrawal for proposed forest reserves. These lands may or may not be restored to settlement and entry, depending upon the recommendations of the experts who made the examinations. The restoration of additional lands, found undesirable for forest purposes, will be recommended as soon as the field-notes are worked up and the character of such lands is established.

On January 29, 1904, by direction of the Secretary of the Interior, the Acting Commissioner of the General Land Office restored to settlement and entry 148,000 acres of the area of 368,000 acres in the Gunnison, Del Norte, Leadville, and Pueblo land districts, in Colorado, which was temporarily withdrawn from settlement and entry on October 3, 1903, for a proposed addition to the San Isabel Forest Reserve, which was established by the President on April 11, 1902.

This is a Bird.

Figures of speech ever dear to the heart or chest of the orator are mighty handy to the propagandist in bringing the blind to see the great benefits to come to mankind from a proper acceptance of the policies of conservative forest management and the reclamation of our arid lands. "Perpetuate the Forests by Wise Use;" "Annex Arid America;" "Save the Forests and Store the Floods," and "Make the Desert Bloom Like the Rose" are slogans familiar to all our readers. And the great and beneficent work of "making two blades of grass grow where only one grew before" has been glorified all the way from the United States Senate to the backwoods school-house. A new figure was born the other day at Cheyenne, Wyo., at an irrigation meeting. A local orator, expatiating on the glorious work of the Reclamation Service, warming to his subject, exclaimed in rapturous tones, "What a wonderful thing it is to be engaged in such a noble work, making two drops of water flow where only one flew before."

Fleeing Homesteaders. Engineer I. H. Taylor, in charge of the Truckee irrigation construction, publishes the following warning statement to people who are already being fleeced of their homestead rights by sharpers, on account of their ignorance of the provisions of the National Irrigation Act:

"Actual and continuous residence on the land is required and title can not be gotten until all payments for water have been made.

"Homesteaders must take water from the government irrigation system, and before acquiring title must have at least half of their land under cultivation.

"Only the main canal from the Truckee River to the Carson River is now under construction.

"Water for a small portion of the land will be available in the spring of 1905, but by far the greater part will have to wait till 1906 or 1907 before water will reach it.

"Until water is at hand for its irrigation no one can make a living upon

these lands; but those filing in advance of the arrival of the water will not on that account be excused from residing thereon. Actual *bona fide* residence is required."

While the above ruling is made especially for the Truckee River project, there is not the slightest doubt that it will apply to the government lands lying under the proposed canals of the Gunnison tunnel project.

Chief Engineer F. H. Newell said in an interview in Denver recently:

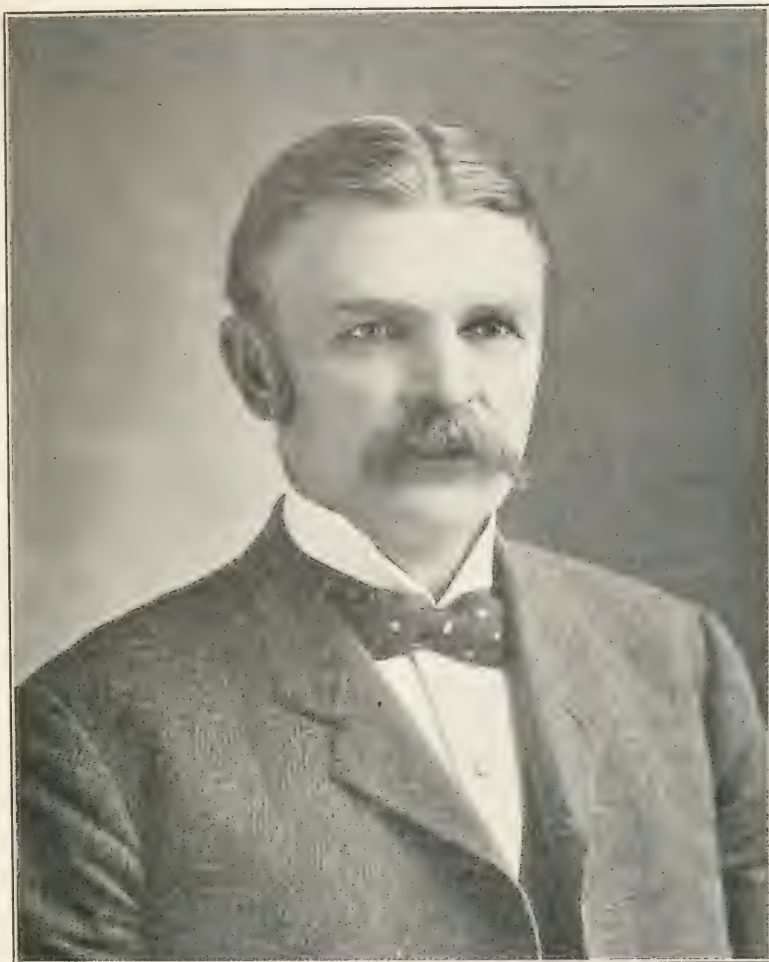
"It should be made generally known that there will be no water available in the Truckee district before 1905. Grafters are rushing ignorant people there and charging them from \$50 to \$100 for locating the land for them. This land is absolutely worthless desert at the present time and there is no way of making a living on it. Homesteaders must live on the land to make their entry good, but it is impossible for them to live on most of this land until water comes."

Expert Forester for Wisconsin.

In pursuance of the policy outlined by the forestry bill passed last year by the Wisconsin legislature, Mr. Edward M. Griffith, of the Bureau of Forestry, has recently been elected Superintendent of Forests in that state at a salary of \$2,500, the appointment to take effect at the beginning of the present month.

Mr. Griffith goes to his new work with the full recommendation of his superiors in the Bureau. Few of our young American foresters have enjoyed broader training in their profession than he. In addition to courses at Phillips-Andover Academy, the Sheffield Scientific School at Yale, and Biltmore Forest School, he has taken part in practical forest work in Germany and the Philippine Islands, and has had opportunity for extensive travel and observation of forest methods in Hawaii, India, and Ceylon.

Both Mr. Griffith and the Wisconsin Forest Commissioners are to be congratulated, the former upon an opportunity for most valuable work and the latter upon the fact that state politics has not prevented their choice of a man trained for the work to be done.



HON. WILLIAM A. RICHARDS,
COMMISSIONER OF THE GENERAL LAND OFFICE.

MR. RICHARDS, as Commissioner of the General Land Office, occupies a position of extreme importance at this time. The gigantic land frauds that have been going on for years, and which continue to-day, owing to our pernicious land laws, render his work of a most trying character. A residence of many years in the public land states of the West was naturally a strong factor in his selection for his present position. For this reason also, it was to be expected that President Roosevelt would select him as a member of the Public Land Commission, which is now preparing a report to Congress. Mr. Richards was born at Hazel Green, Wis., on March 9, 1849, and later removed to Wyoming, where he filled the position of surveyor-general of that state from 1889 to 1893; he was later elected governor of Wyoming, serving from January 1, 1895, to January 1, 1899.

PRACTICAL FORESTRY FOR LUMBERMEN.*

REASONS FOR CONSERVATIVE HANDLING OF REMAINING TIMBERLANDS AND FINANCIAL RESULTS THAT MAY BE EXPECTED.

BY

OVERTON W. PRICE,

ASSISTANT FORESTER, BUREAU OF FORESTRY.

IT is not the province nor the purpose of the Bureau of Forestry to attempt to teach the Southern lumberman the details of his business. I think that every man who has looked into it must realize that the United States owes its interior development, more than to anything else, to the enterprise, the industry, and the skill, of those whose efforts have put the lumber industry upon the plane which it occupies today. If lumbering had not opened the way, the South would never have reached the commercial and industrial activity which she is now enjoying.

From the first attack upon the forest of your earliest forerunner, the colonist, your industry has increased steadily, until it is now fourth among the great industries of the United States. It has grown rapidly from small beginnings, fostered by the presence of an apparently inexhaustible supply of timber and by the impetus of an insistent demand. From "whip-sawing" to the modern steam sawmill is a long step, but it has not taken much over fifty years to accomplish it.

The present tendency of your industry is strongly toward economy. This is shown in your mills and in your methods for the transportation of lumber, but it is shown least of all in your dealings with the forest. This is the line of economy which it is the business of the forester to develop. The urgent need for such economy requires no statistics to prove it. You all know far better than I what is the situation confronting your industry today: that species and grades not long ago unknown in the market are now bought eagerly; that, in spite of the

decrease in the cost of logging and of sawing, the price of lumber climbs steadily higher, and that there are already certain kinds of wood of high commercial value which are practically out of existence as a factor in the lumber supply.

Hitherto you have not had to consider the production of a second crop upon lands on which you have lumbered. So long as sufficient merchantable timber stood in sight to keep your mill running long enough to pay for it, and to yield in addition a generous return upon the capital invested in it, you naturally were not led to consider the future. That fact has been used by many enthusiasts as cause for criticism of lumbermen's methods as intemperate as it has been unjust. The question whether you shall cut with a view to immediate returns only or whether you shall cut also with a view to cutting over the same land again involves no emotional considerations, but is a question of business and of business only. I want to make it very clear that the forester—and by forester I refer not to the mere enthusiast, but to the man who deals with practical forest problems at first hand—is not an enemy to the lumberman. On the other hand, the highest effectiveness of the forester's work is impossible without the coöperation of the lumberman. The proof of the soundness of the forester's methods lies in the success of their practical application. Unless the forester can prove to you that forestry pays, and coöperate with you in putting it into effect, then his efforts have been in large part fruitless.

There are a good many kinds of for-

* Address delivered January 19 before the Southern Lumbermen's annual meeting, at New Orleans, La.

forestry. There is the forestry which must consider indirect returns. There are cases in which the management advised for a forest must give weight to the value of that forest as a conservator of stream flow, and must not ignore its effect upon winds, upon climate, or upon the national economy. Such considerations must often govern in the forestry which is applied to public lands, since the long-time owner may consider such matters, and since the forest lands which are the property of the nation should be handled for the greatest public good, rather than for the highest immediate profit. For example, the best administration of the 60,000,000 acres of federal forest reserves must be based upon such a point of view. But these are not matters which you are called upon to consider in the management of your own lands, nor is there, in my judgment, a more serious mistake than to expect that private enterprise should or can be governed by considerations of indirect returns.

But there is another kind of forestry, the kind which I wish to present to you, which is purely a matter of business and which makes no other claim upon your approval or rejection. What we call practical forestry, which is merely another name for conservative lumbering, differs from the lumbering which you do only in its point of view. Practical forestry does not ask you to expend one cent unless there is reasonable promise that you will get a profitable return from its investment. It does not require you to consider indirect returns, such as I have just mentioned must influence the management of the forests of the public owner. It simply presents to you upon a business basis the results which you may expect from lumbering your lands, with a view, not to lumbering the same area once, but to lumbering it repeatedly. It simply enables you to take advantage of the fact that since trees have grown once they will, under proper treatment, grow again. Practical forestry does not mean that you will have to plant trees on your cut-over lands and wait until they have reached maturity in order to harvest them. That kind of forestry appeals only to the long-time owner, to

the state or to the nation, or to the private land-owner in the treeless regions of the West, who, in order to have trees at all, must first plant them. But on practically every piece of land which you lumber there is left standing after the logging a certain number of immature trees—trees some of them slightly, some of them far below the diameter of the logged trees. If you log in such a way that these immature trees are broken by the fall of those which are cut, or if your cut-over lands are burned after the logging, the possibility of a second crop from them is so decreased as to be of no practical moment. But if, on the other hand, you lumber in such a way that these young trees, which form the basis of a future crop, are preserved both in the lumbering and afterwards, the second crop will in many cases become a factor of no small financial importance in your undertakings.

Whether it will pay you to foster this second crop, both in your cuttings and afterwards, is the important question. For example, the Bureau of Forestry has found that in some cases the returns from practical forestry will yield an income of 6 and even a higher per cent upon the capital invested. In other cases the interest is lower, and in others again it entirely disappears. In other words, forestry is not a panacea that can be applied to lumbering under all conditions and in every locality, but in the vast majority of cases it will pay, and pay well, to cut in such a way that you may cut again. Just how well it will pay, the Bureau of Forestry is ready to determine, and will be glad to determine, in coöperation with any one of you. It will give you, at a cost equal only to the actual living and traveling expenses of its agents engaged in the work, a detailed plan for the management of your tract, based upon a thorough study on the ground. This study will determine what is the present merchantable stand of timber upon your lands, what small trees remain as the basis for a second crop after the first crop of merchantable timber is cut, how fast these small trees will grow—and they will grow much faster after the old trees are removed—and what

interest their growth will represent upon the capital invested in the land. It is not the intention of the Bureau to foist upon you any European system of forestry not adapted to your needs, but only to recommend, upon the basis of a thorough investigation, modifications of your present methods when such modifications will yield good returns. For example, let us suppose that you are cutting pine of merchantable size for lumber, and putting smaller pine into cross-ties. It would be the province of the Bureau to determine whether or not it would pay you best to allow all pine to reach lumber size and simply cut ties out of the tops, thus taking advantage of the more rapid growth of the smaller trees. In the same way you will often have to determine whether it is more profitable for you to tap small trees for turpentine or to let them grow until you can cut them for lumber. The forester can answer this question on a basis, not of surmise, but of a comparison of the value of these trees for turpentine and for lumber based upon actual measurement of how long it will take them to make lumber. Many of you are now using countless numbers of thrifty young pine for spur ties, for corduroy, for bridges, and for skids. The forester can tell you what these young trees are worth, because he can find out from actual measurements how long it will take them to make lumber and how much lumber they will make. And he will in many cases show you that you are throwing money away in using young pine trees for such purposes, and that you can save this waste by utilizing instead the tops of logged trees, culls, or trees of a kind less valuable than pine. In principle, practical forestry is an exceedingly simple matter; in application it requires trained men, both to solve its problems and to put their solution into effect.

Whether you will practice forestry or whether you will lumber in the ordinary way is simply a question of whether you will treat your forest as a gold mine, ignoring its productive capacity, or whether you will lumber conservatively at a cost very little higher than under your present methods, and which will

be repaid you many times over. Forestry can never offer you the spectacular opportunities for the investment of capital which the ordinary lumbering of a practically inexhaustible supply of timber has offered you and your predecessors. The trees do not grow fast enough for that. But they grow fast enough to make their preservation a good investment, and, with protection from fire, an eminently safe one. You are inclining more and more strongly toward greater capitalization of your mills and logging equipment and toward greater concentration in your logging operations. The era of the portable sawmill is practically over. There are few areas left in which a man can skim the cream of the timber and let the rest remain. You are cutting closer and closer year by year and you are attempting by improved machinery to offset the disadvantages of poorer timber and less accessible sources of supply.

Improved machinery is an excellent thing; economy in the mill is admirable also; but these alone will never solve the urgent problem before you. It is only by economy in the woods that you can, where there is reasonable safety from fire and where other conditions are favorable, make your plant, so to speak, self-supporting. If you omit economy in the woods, all economy elsewhere will only serve to postpone somewhat the time when your mill must shut down. It is perfectly natural that you should not turn with eagerness toward forestry, because you are just at the end of an era in which a plentiful supply of timber rendered it unnecessary for you to practice it. But now there is the question immediately before many of you whether you will lumber in such a way that you may keep your mill running continuously and draw a fair profit from your operations, or whether you will skin the land, shut down the mill, and look elsewhere for an opportunity to carry out the same policy. The former method means in the vast majority of cases a safe and conservative business enterprise yielding fair and assured returns; under the latter method you may make more money for a little while, but you will inevitably in the end be forced

either to practice forestry or to cease your operations.

I do not want to dwell here upon the effects of these two methods upon your industry as a whole. That is not the question before us today, although it is one which vitally concerns the interior development of this country. I merely wish to bring to your notice the fact that practical forestry has certain business advantages. You will not deny that you consider your mill as a part of your plant. Why not look upon your forest as a part of your plant also? The power to produce and yield you good returns is in the forest just as much as in the mill. It is simply a question whether it will pay you to develop that power, and that is a question which can in every case be determined. It is merely a comparison of capital and of interest. The value of your cut-over lands represents the capital; the rate of growth of the trees upon them represents the interest. If in 10 years, or 20 years, or 30 years, or what-

ever the period may be, you could cut a second crop from logged-off lands, whose value, less the cost of the taxes and protection of the lands during the same period, represents a fair interest upon their capital value, then forestry is for you a good and safe investment. No man here would throw away anything which might have a money value until he had first determined whether that money value actually existed. I merely wish to present to you the advisability of applying the same policy to cut-over lands. Before you let your cut-over lands revert to the state for taxes, or before you lumber them in such a way that their productive capacity is destroyed, or before you let fire run through them, or before you sell them at a low figure as agricultural lands, first determine what they can yield you in a second crop; and in doing that the Bureau of Forestry is not only willing, but eager to give you its help in every possible way.

DESTRUCTIVE EROSION ALONG THE KANSAS RIVER.

BY

GEORGE W. TINCHER.

THE accompanying illustration shows a scene in the Kansas River valley immediately after the water had receded from the May and June flood of 1903. The area shown was a sweet-potato field ten days before the photograph was taken.

The ruined land, which was used for garden purposes, belongs to the State Hospital for the Insane, located on the south side of the Kansas River, at Topeka, Kansas. In 1900 the superintendent of the hospital caused all the native timber to be removed from this plot of ground. He removed not only the trees, but the stumps as well, leaving the ground in an excellent condition for growing garden crops. Unfortunately, the process also left the ground in a favorable condition for total destruc-

tion by the overflow from the river. The strip of ground shown between the pool of water in the foreground and the river beyond was formerly the bank of the river. A large ice-house which occupied a site at the end of this strip, quite near the river's edge, was destroyed and swept away with its contents.

The action of the water destroyed about five acres of land, extending 200 x 1,000 feet. The flood came with such force that everything was swept before it. The white strip shown in the distance to the center and the right is pure sand, which was deposited upon the land over about 60 acres, making the area wholly unfit for cultivation. This land was held and sold at \$100 per acre before the high water.

The large water pipe which is being



DESTRUCTION OF AGRICULTURAL LANDS ALONG THE KANSAS RIVER, RESULTING FROM THE SPRING FLOODS OF 1903.

elevated from the pool of water belongs to the Topeka Water Company, which sustained a loss of about \$2,500. The city of Topeka was without fire protection for more than two weeks on account of injury to the mains. A destructive fire would simply have run its course without interference at this time. The tracks of the Chicago & Rock Island Railroad were not only destroyed, but it was necessary to make a "fill" a thousand feet long, in some places sixteen feet deep, in order to lay the rails again. It is estimated that this work cost the company more than \$3,000. At its highest stage the water was eight feet deep on the knoll at the right, where the team of horses is standing.

All this loss of property was caused by the removal of the native timber in 1900. This fact is especially noticeable because the ground just above this point was not damaged in the least, the land being really improved by the deposit of silt and mud, although the crops growing upon it were destroyed. The reason of the immunity of this land is that the owners allowed a portion of the native timber near the river bank to remain intact, and this growth checked the current. The owners of land which is liable to be thus overflowed should maintain

a fairly good forest growth, in order to protect the land and adjacent property. Considering the nature of the soil in this valley (a light sandy loam), it is a dangerous proposition to remove all the tree-growth, as the above illustration shows more forcibly than any mere description can.

As a future protection, this and all the damaged land along the valley should be planted to timber. Valuable species, such as the Hardy Catalpa, Green Ash, Osage Orange, Black, and Honey Locust, and lastly the Oaks, Walnuts, and Hickories, could be used to advantage for this purpose. If the land is neglected it will become a worthless jungle of Cottonwoods and Willows. Land owners should plant trees which will serve the double purpose of protecting the soil and producing valuable timber when grown. All the sand land should by all means be planted to trees, for in a few years they will give back to the soil considerable humus by means of the falling leaves and dead branches.

The time to begin this work is at once. The farmers of this region should not procrastinate for ten or a dozen years, and then lament over a lost opportunity for doubling the value of their land. The planting of trees will not prevent

an overflow, but it will protect the land so that the injury of the flood will be limited to the growing crops. This would seem to be a most important point for the owners of all low land along these rivers to consider. They should provide for protection of this bottom land so that loss may be confined to one season's growing crop.

Catalpa and Green Ash can be grown quite near the water, and should they be under water for a reasonable length of time they will sustain no serious damage. Fruit trees, however, will not stand immersion, as the presence of thousands of dead trees in the Kansas valley shows at this time.

It is hoped that many acres of this damaged land will be improved to such a degree that by 1915 it will be as valuable as any portion of the neighboring

farms. The Bureau of Forestry can be of great assistance in these operations in the way of furnishing general information and instruction in regard to the most advisable ways of solving the varied problems to be met on every hand. During the year 1904 we should see a good start made toward permanent improvement of this valley, which is one of the richest and most productive bodies of land in the United States.

(EDITOR'S NOTE.—Mr. G. L. Clothier, of the Bureau of Forestry, has recently made a study of the conditions in the Smoky Hill and Kansas River valleys, from Salina to Kansas City, and by public discussions and otherwise has endeavored to stimulate the planting of trees along the streams both for protection from erosion and also to reclaim lands covered by sandy deposits.)

THE BLUE GUM.

A BRIEF STUDY OF EUCALYPTUS GLOBULUS AND
OTHERS OF THE SAME GENUS IN CALIFORNIA.

BY

JOHN B. ANDERSON,

BUREAU OF FORESTRY.

THE Eucalypts are natives of Australia. About the middle of the last century they were imported into this country, but until about thirty years ago they were not planted extensively.

Of all the species, numbering about 150, the common Blue Gum (*Eucalyptus globulus*) has received the greatest attention; in fact, it is practically the only Eucalypt planted on a commercial scale in the United States.

This tree is found from a point more than 200 miles north of San Francisco southward along the coast into Mexico.

It does not seem to thrive inland, except in favored localities, where the temperature does not fall below + 18 degrees and where irrigation is available or the ground water is near the surface. The region where it thrives

best seems to be just south of Los Angeles, around Florence, Compton, Santa Fé Springs, Long Beach, and the vicinity, though we also find fine groves at Berkeley, Newark, El Cajon, and Santa Barbara. The Eucalypts will necessarily remain confined to this region in California, and perhaps to certain limited areas along the Gulf coast. It is useless to try to introduce them in any other parts of the United States.

The soil best adapted for the growth of Eucalyptus seems to be a deep sandy loam with the ground water close to the surface, such as is found in the Los Angeles Valley. The soil here is strongly alkaline, but this fact does not seem to affect the growth of the trees in a deleterious way.

Along the coast the heavy fogs enable the tree to grow without irrigation.



BARK LEAVES AND BLOSSOMS OF THE BLUE GUM (*EUCALYPTUS GLOBULUS*).

Mr. T. P. Lukens, of Pasadena, during a fog in that city placed a pan under a Eucalypt, and during one night obtained one-fourth of an inch of water which the tree had condensed. At Garden Grove, in early September, a road which passes beneath a grove of Eucalypts was as wet in the morning as if there had been a considerable shower during the night.

The Blue Gum grown in a forest produces a long, fairly straight bole, with practically no limbs large enough for fuel. The tree prunes itself. The dead limb is severed underneath the bark, and drops off, leaving a slight hole, and no protruding portion, which gives the tree a very clean appearance.

There are two seasons for blooming, one being in the early summer and the other in early winter. Different trees, however, differ widely, so that flowers may be obtained almost any time. The fruit ripens about the same time as the tree blooms. This point is a fair test of ripeness when looking for seeds.

The Blue Gum is easily raised from seed. The seed should be sown three to four months before it is desired to set out the young plants. One of the easiest and best ways is to plant the seeds in patches about two inches apart (planting several seeds in each patch) in boxes of sandy loam and then cover with one-quarter inch of beach sand. The boxes should be three to four inches deep. A convenient size is fifteen by thirty inches; such a box would contain one hundred patches. After the young plants have reached a height of one inch they should be thinned out, leaving one strong plant in each patch. The plants thinned out might be transplanted to other boxes or seed beds, placing them again two inches apart. The seed boxes should be kept constantly moist.

The seed will sprout in about two or three weeks, and should be six to ten inches high in three or four months, which is the best size for planting. The field which is to be planted should be well prepared. As soon as the rains begin it should be plowed deeply, say six to ten inches, and then left to give the weeds a chance to sprout; it should then be plowed again lightly and broken

up with a harrow. If the grove is being planted for fuel, 8 x 8 feet is probably the best distance to separate the trees.

The trees should be cultivated for two or three years, until the ground cover is well established. The ordinary rule is to cultivate five times the first year, three times the second year, and often enough afterwards to keep the weeds out. The matter of cultivation is exceedingly important, and unless it can be thoroughly done it would be better not to try to raise Blue Gum. As an example of the results of neglect, there is at Santa Fé Springs a small grove which was planted and cared for the first year until the rains came. Cultivation was then neglected, and the weeds and gophers obtained free access. In December, 1902, there was scarcely a tree missing from the rows, while in December, 1903, one year later, over half the trees were dead and the grove beyond saving.

The cost of planting and cultivating for two years should not exceed \$25 per acre on fairly good land. This estimate includes the preparation of the ground, raising or buying the plants, the planting, and the subsequent cultivation. The best time for setting out the young plants is in January, February, March, and April. In exposed regions, March and April are preferable, in order to escape the frosts and severe winds of January and February. If there are early rains, November is a good month. The best time to cut old trees, in order to secure a good reproduction by sprouting from the stump, is between November 1 and March 1. This was noticed in an examination of most of the groves of southern California.

Thinning will pay a trifle more than the expense of cutting out the surplus sprouts. All the sprouts should be allowed to grow the first year, and during the second year should be thinned to two or three sprouts on a stump. The stumps of trees after cutting sprout well up to ten years of age, after which their power of reproducing appears to wane. Usually four or five cuttings, at intervals of from five to ten years, may be made from the sprouts, after which the old

stump will be found rotted, the main tap root dead, and what sprouts do start will be feeble than the earlier ones. At this time it will probably pay to kill the old stumps entirely and replant the ground. This can be done by burning around the stumps.

The Blue Gum is one of the most rapid growing trees in the world. On average soil it will produce 500 cubic feet of new wood per acre per year, which is about six times as much as is produced by the trees on an eastern woodlot in the same time.

At Florence an acre five years old is said to have produced 50 cords.* An adjoining acre, 7 years old, produced 75 cords, and still another adjoining acre produced 135 cords in ten years. These figures show that the tree produces more wood by being left ten years than if cut twice, once every five years, as is the usual custom.

* The California cord contains only about 96 cord feet. It is a pile 3 feet high and 32 feet long, and from 8 to 14 inches, with an average of 12 inches, wide, thus making about three-fourths of a true cord.

At Santa Fé Springs a grove five years old produced an average of 34 cords per acre. This is about the average growth of the Blue Gum on good soil.

The wood is worth \$6.50 per cord, cut and piled; it costs \$3 per cord for cutting, making its value on the stump \$3.50 per cord. This shows a net profit of \$23.80 per acre for each of the five years of growth. As the land is valued at \$200 per acre we have as interest on the investment a gain of 11 per cent. Other groves give 25 cords per acre in five years, or about 8½ per cent on the investment.

A favorite use of the Blue Gum is for windbreaks. Owing to its great height and rapid growth, it easily stands at the head of the list for this purpose. Pollarding the tree at six feet the first or second year after planting causes it to form a thick growth near the ground, while the main stem shoots up at the rate of ten feet a year for ten years, and then grows more slowly. The main stem is very flexible and bends with the wind, thus forming a sort of cushion which



A VIEW IN EAST LAKE PARK, LOS ANGELES, CAL., SHOWING EUCALYPTS AS SHADE TREES.



THESE BLUE GUMS ATTAINED AN AVERAGE OF 26 INCHES IN DIAMETER IN 27 YEARS.

tends to deflect the air current upward and over the grove.

The percentage of culls from orange orchards in some of the most windy sections of California runs from three per cent in well protected groves to fifteen per cent in groves with no Eucalypt windbreaks, three to six per cent being the average for protected groves, and twelve to fifteen per cent for unprotected groves. A good windbreak will protect the orchard for about forty rods. In the regions near the foothills the windbreaks should be nearer together. The trees should be planted quite closely in the rows, four feet being about the right interval.

A very good windbreak is made by planting Blue Gum and Monterey Cypress (*Cupressus macrocarpa*) alternately. The Cypress makes a dense undergrowth, while the Gum gives the desired height. The disadvantage in this expedient is that the Cypress is short lived.

One of the greatest faults found with the windbreaks is in the effect of the vigorous roots of the Blue Gum sapping

the ground, rendering the first row or two of fruit trees unproductive. This, however, is overcome to a great extent by digging a trench three and a half feet deep every other year parallel to the windbreak, and cutting off the roots of the windbreak trees. The trench must be refilled or the Eucalyptus roots will pass under it and necessitate deeper digging next time.

Two manufacturers are using Blue Gum at present, one as center pieces for tables and the other in the construction of wagons. The latter makes every part of the wagon, except the hubs, from it, and is very enthusiastic over it as a construction material. He says that the Blue Gum is much superior to the Hickory or Ash which is received from the east. The best second growth Ash or Hickory may be actually better, but this grade of timber cannot be had out there, so the Blue Gum is the best wood obtainable in the state.

It is not as elastic as Hickory, but is stiffer. It lasts as long as any other hardwood, and does not check or warp any more than the others. But Blue

Gum requires more time in seasoning than Ash does; from two to three years being required to season it thoroughly.

As soon as the tree is cut, it is sawed up into planks for three reasons: it is more easily worked, it seasons more quickly, and it checks less. After it becomes dry it is very difficult to work, being almost impossible to shape with hand tools.

The grain is very twisted, and a draw shave can not be used, for the grain runs in all directions. After the planks are sawed, they are underpiled with an air space between them. Small pieces are used for insulator pins on telegraph poles. They are boiled in order to hasten their seasoning. They are also boiled in linseed oil, to preserve them. These pins are of various sizes, from six inches long to two feet, costing from three to five cents each. For wagon tongues the logs are sawed into twelve-foot lengths, and for racks into sixteen-foot lengths. In all possible cases the sawing is done to these lengths. Shorter pieces are used for spokes and other small parts. Besides these are made plow-beams, harrows, neck-yokes, and posts for electric cars.

In some mines near Escondido, Blue Gum is used for timbering. It has been in use for this purpose during the past three years and has given very satisfactory service, insomuch that the owners of the mines are determined to continue its use. However, its chief use is for fuel, and it is to-day the principal fuel of southern California. When first cut, it splits and saws fairly well, but if allowed to lie in the sun for a few days, it rapidly loses its sap, and becomes so hard and tough that it is almost impossible to work it up into stove wood. It rots very rapidly when used for posts and can not be recommended for this

purpose, but, strangely enough, it seems to possess excellent lasting qualities when used in submerged positions, such as piling, especially in salt or brackish waters.

In California there are at present almost 2,800 acres in Blue Gum. During the present winter many more acres will be planted. Besides the Blue Gum other useful species are the Sugar Gum, which will stand the most drought of any of the commercial species, and which produces better fuel than the Blue Gum, works easily, being straight grained, and makes a good post. It produces many flowers, which yield a good grade of honey.

The Red Gum (*Eucalyptus rostrata*) lasts a long time in the ground, making a good post, but for fuel or piles it is not of much use, being rather soft.

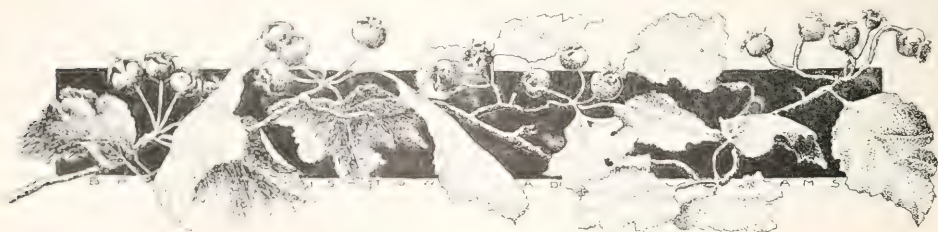
Eucalyptus sideroxylon, or Iron Bark, is a slow-growing tree, but makes an exceedingly hard, heavy wood. It is an excellent post tree.

Eucalyptus punctata is not yet planted on a large scale, but, judging from the few specimens now growing in California, it promises well, and should prove a good timber tree.

Eucalyptus diversicolor is another rare tree. The few specimens planted in parks grow very rapidly. It also will make good timber.

Eucalyptus resinifera and the other Mahogany Gums, while very sensitive to frost, could be planted in many localities, and, on account of their fast growth and beautiful grain, should make very suitable cabinet wood.

For ornamental purposes *Eucalyptus rostrata*, *viminilis*, *cornuta*, *fecifolia*, *citriodora*, and *calophylla* are probably the best. For a honey tree *Eucalyptus polyanthima*, *corynocalyx*, *robusta*, and *cornuta* may be recommended.



THE BUILDING OF EGYPT.

HOW A GREAT IRRIGATION ENTERPRISE IS DEVELOPING THE RESOURCES OF THAT COUNTRY.

BY

WILLIAM E. CURTIS,

SPECIAL CORRESPONDENT OF THE CHICAGO "RECORD-HERALD."

IT is a disputed question what the average Egyptian thinks of the amazing improvements that have been made in the material condition of his country during the last few years and how they have affected his character. Many people believe that he scarcely realizes them ; that they have not touched his soul or even his consciousness at all, and that he still retains his mediæval conservatism in spite of the public order and security, the relief from taxation,

the even hand of justice, the means of education, and the higher wages that have been brought to him by the English administrator. It is true that the oriental soul is very different from that which inhabits the body of the white man. His ideas are not our ideas, and his religion, his social habits, his impenetrable reserve, his serene contemplation of fate, and other peculiar characteristics, whether good or ill, have not changed since the middle ages ; and



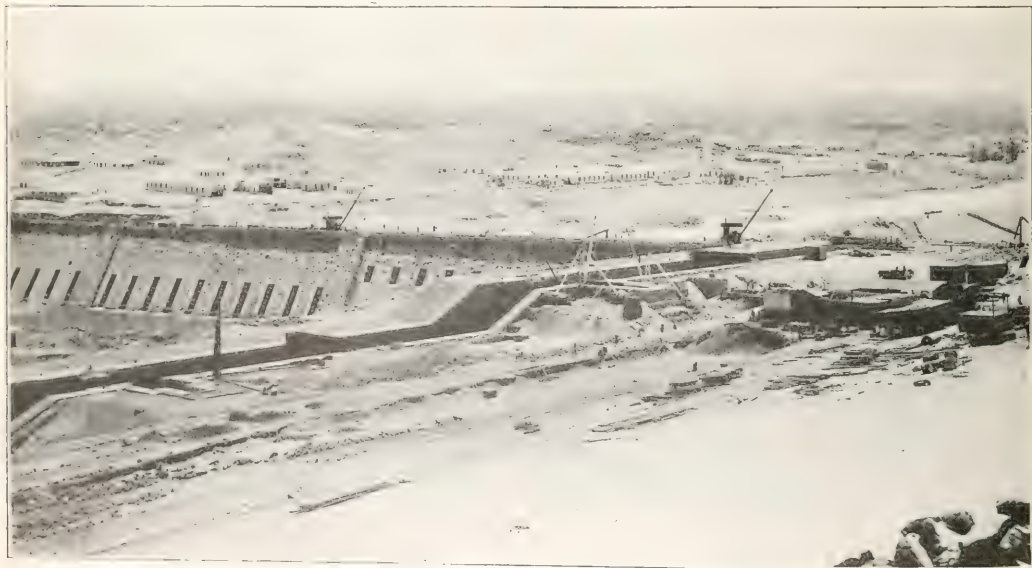
CONSTRUCTION OF THE ASSUAN DAM AT AN EARLY STAGE. LAYING THE FOUNDATIONS ON BED ROCK.

although he has adopted modern costumes to a considerable extent and has allowed the women of his family to come into contact with foreigners, he moves very slowly. Even Cairo, with all its modern improvements, retains its mediæval customs and appearance, and is still the city of the Arabian Nights. No matter how much of the surface may be covered with new buildings, old Cairo remains, and will remain, and the evidence of modern life we see is only a veneer. Nevertheless, it is scarcely possible to believe that the farmer does not appreciate what has been done for him. The signs are certain, as I will explain. He can not be insensible to the improvement of his condition.

It is also a question of even greater importance, particularly to us, how much the cotton crop of Egypt will be increased by the construction of the new dam at Assûan and the extension of the irrigation system. The cotton-growers of the United States, however, need not be alarmed. It will be a long time before the cotton fields of Egypt are extended to a degree that will be felt by the planters of the United States, and the increase will be much less than is popularly expected.

Under the present system the valley of the Nile is producing all that it is

capable of, and the only way to increase the products and the wealth of the country is to bring more land under irrigation. The present area has not been increased to any considerable extent for many centuries, although projects have been frequently proposed. When Joseph, the son of Jacob, was prime minister for Pharaoh he conceived the idea of turning the surplus water of the upper Nile into what is known as the province of Fayum, about fifty miles south of Cairo. A vast depression in the desert, known as Lake Mœris, by his skillful engineering, became a productive oasis, which has added hundreds of millions of dollars to the wealth of the nation. Mr. Cope Whitehouse, son of the late Bishop Whitehouse, of Illinois, who has spent much time in Egypt, and is familiar with the desert, as well as the irrigation system, submitted to the government a few years ago a plan to extend the irrigation system built by Joseph and utilize it for the benefit of the country. The khedive wrote him a letter of thanks and conferred upon him the decoration of a grand commander of the Order of the Medjidjeah, but his English advisers poked the plan into a pigeon-hole and no one has ever been able to persuade them to pull it out again.



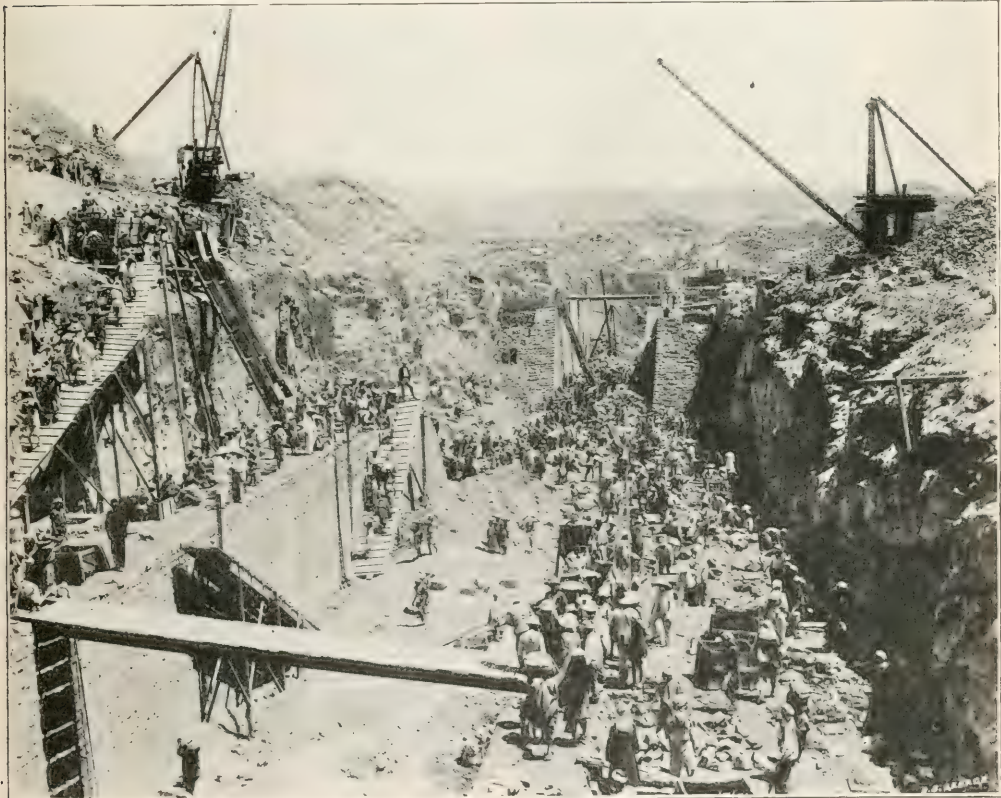
THE LOCKS BY WHICH VESSELS PASS AROUND THE WEST END OF THE DAM.

Their indifference, however, was due to other plans which they considered more practicable, and it was determined to construct an enormous dam at the first cataract near Assûan, which stores all the water that is not needed at the annual inundation and allows it to be released when it is needed later in the season. This dam is now completed.

It was begun in February, 1898, a contract having been entered into with Messrs. Aird & Co., a Scotch firm, who agreed to build it for \$10,000,000, payable in thirty semi-annual installments of \$400,000 each, including interest; but they do not get a dollar until it is completed. The foundations of the dam rest upon solid granite ledges; it is 6,786 feet, or about a mile and a quarter, long, 120 feet high from the rock bottom, 82 feet thick at the base, and 26 feet wide at the top, where there is a roadway guarded by walls which take the place of the bridge which has long been

needed. The dam contains 1,250,000 tons of masonry and about 15,000 tons of steel. The masonry is of rough granite blocks laid in cement, and the materials have been taken from quarries which for 7,000 years supplied stone for the obelisks, pyramids, temples, tombs, and palaces of Egypt. There are 180 sluices through which the water can be released when it is needed, and they are fitted with steel gates that can be handled by electric machinery. Every convenience and apparatus known to science has been applied where it is needed, and if this dam had been built a thousand years ago it would have been ranked among the wonders of the world.

It is one of the greatest engineering triumphs in history. Its construction has been immensely more difficult than the Suez Canal, and it differs from that famous public improvement in the important particular that no money was stolen or wasted.



NATIVE LABORERS AT WORK ON THE LOCKS.

The dam was designed by Sir William Wilcocks, an English engineer, in consultation with Sir Samuel Baker and Sir Benjamin Baker; the foundation stone was laid February 12, 1899, by the Duke of Connaught, and the formal completion was announced December 10, 1902, by the same gentleman, the brother of the king, when the khedive turned a key which put in motion the electric dynamos which are to furnish the power to operate the sluice gates.

The construction of this dam creates a reservoir 140 miles square, which is

capable of storing several billion tons of water. The difference in the level of the river above and below the dam is 67 feet, and navigation is assisted by a series of four locks, each 400 feet long and 35 feet wide. They will save great delays and cost in the transportation of merchandise, which is one of the most important benefits to be derived from the enterprise. Formerly navigation up the rapids was very expensive and tedious, for all the boats had to be towed by Nubians at a considerable cost.

During the construction of the dam



ONE OF THE GATES WHICH OPERATE THE LOCKS. ORIGINALLY DESIGNED FOR THE NICARAGUA CANAL.

an average of 11,000 men were employed for more than three years, of whom 900 were Italian stone masons, and they laid an average of 3,000 tons of masonry each working day.

It is intended to utilize the water of the cataracts, now running entirely to waste, in a great electric plant like that at Niagara Falls, to supply heat, light, and power to the towns on the upper Nile, which will doubtless attract manufacturing, for plenty of labor is to be had; but, of course, the greatest utility of the dam is to extend the irrigation system and bring under cultivation the desert, which comes down to the river on both sides.

Now that the dam has been completed, however, it will be necessary to construct a system of canals and pumping apparatus to convey the water where it is needed. Messrs. Aird & Co. have a contract for this work at a cost of \$10,000,000 on similar terms—that is, they are to be paid in installments as rapidly as the contract is carried out, and it is estimated that at least ten years will be necessary for that purpose.

Various enthusiastic estimates are made as to the area of desert that can be reclaimed and the revenues that will be derived by the government and the wealth that will be added to the nation, but it will be many years before expectations can be realized, and, so far as the cotton problem is concerned, the demand for the Egyptian staple will increase more rapidly than the supply. Egypt produces from 1,000,000 to 1,200,000 bales. As soon as the water from the dam can be utilized the crop will jump up perhaps 50,000 or perhaps 100,000 bales, and gradually increase until the total reaches 1,500,000 bales of 500 pounds each. There it must stop for years until the irrigation system is still further extended.

A considerable portion of the land to be improved belongs to private parties, who, of course, will have to pay their share of the cost of the improvements indirectly, if not directly. The government has already sold a tract of 160,000 acres to a syndicate, which will build an irrigation system to bring it under cultivation and sell it for an ad-

vance. Most of the government land is sold at auction. A bureau under the minister of finance has charge of such affairs, and when a man wants to buy a tract of land he enters an application there for it. This fact is advertised in the official newspapers, and bids for the same piece of property are invited from other people. The applicant may be the only bidder. In most cases he is, but the fact that there can be competition is a protection against speculators, and nobody can obtain a large tract without exciting attention and competition.

During the last year 6,594 acres were sold in 161 transactions. The largest lot was 1,200 acres. The remainder averaged less than 30 acres. The unsold available government land now amounts to 158,464 acres, and is valued at \$16,655,000, which indicates the extraordinary effect of the introduction of irrigation. The proceeds of the 6,594 acres sold during the year 1902 amounted to \$1,116,000, which is an average of \$175 an acre.

Poor men who want to buy land can borrow money for that purpose from the National Bank of Egypt at a low rate of interest upon a government guarantee. This benevolent feature of a paternal government has done a great deal of good, although it was adopted only three years ago, in October, 1900. More than 34,000 fellaheens, as the peasant farmers are called, have taken advantage of it and have borrowed more than \$2,000,000 at 3 per cent interest. The bank makes the advances, but the government, through the agency of its tax gatherers, collects the interest and principal when due at the same time as a part of the land tax. Thus the bank, being relieved of the necessity of maintaining an expensive staff of subordinates, is able to advance small sums at a relatively low rate of interest. The insignificant amount loaned to each enables it to distribute a comparatively small sum among a great many people. More than one-half of the loans thus far made have been for less than \$150, and most of them were payable in five years.

The Bank of Egypt having declined to invest more than the \$2,000,000 al-

ready loaned, the government advanced it \$1,000,000 additional for the same purpose.

"There can be no doubt," Lord Cromer says, and he has taken a great interest in this scheme, "that the Egyp-

tian peasants are beginning to realize the advantage of owning their own farms, and are learning to take advantage of the benevolence of the government."

The agricultural department is managed with energy and great success. It



THE NORTHERN OR DOWNSTREAM FACE OF THE DAM. (PHOTO REPRODUCED THROUGH COURTESY OF BUREAU OF SOILS, U. S. DEPARTMENT OF AGRICULTURE.)

is introducing new methods and machinery and seeds of new plants among the farmers, and is showing them how to get the best results from their labor; but with all these improvements and advantages the poorest farmer in the United States is as comfortable and as well off as the richest of the fellaheens. The sod huts in which the prairie pioneers lived

during their first year on the western homestead are palaces compared with the filthy hovels occupied by the farmers of Egypt. There is no class in Europe so destitute of comforts and all that goes to make homes and happiness. The poorest Italians are better housed and fed and clothed than these dark-skinned agriculturalists of the Nile.

PLANTED PINE IN NEBRASKA.

A REPORT SHOWING THE SUCCESS OF A PLANTATION
STARTED THIRTEEN YEARS AGO IN THE SAND HILLS.

BY

CHARLES A. SCOTT,

BUREAU OF FORESTRY.

[The data obtained from this examination are of peculiar interest in their bearing upon the afforestation of the Nebraska Sand Hill region, at which a considerable beginning has been made, under the direction of Mr. Scott, within the past two years. The unprepossessing Jack Pine, so long despised by the lumbermen of the Lake States, evidently has a right to consideration as the most useful tree in the reclamation of these barren wastes.—EDITOR.]

A PLANTATION of Pines, commonly called the Holt County Plantation, covers .52 of an acre on the ranch of Bruner Brothers, four miles west of Swan Post-office, Holt county, Nebraska.

It is rectangular in form, measuring 70 by 192 feet, and is located in sand hills bordering a dry valley and so disposed as to include within the area all of the exposures and conditions common and characteristic in the sand-hill country.

The trees in this plantation were set out in the spring of 1891 as three-year-old seedlings, averaging about 8 inches in height. These seedlings were furnished by the (then) Division of Forestry, and planted by the owners of the land according to the provisions of a planting plan prepared by the Division. Furrows were turned 2 feet apart and the trees were planted 2 feet apart in the furrows. Every alternate furrow was planted with Jack Pine (*Pinus divaricata*), and in the intervening furrows were planted Scotch, Austrian, Norway, and Western Yellow Pine. The Jack

Pines were forest seedlings. Just 50 per cent. of these seedlings died before October 15 of their first year.

Since planting, the trees have received no cultivation whatever, but they have been carefully protected from fire and stock, and the response of the little conifers to this care is demonstrated in the fact that fully 90 per cent of the balance of these seedlings grew.

The absolute altitude of this location is 2,200 feet. The greatest extent of the plantation is from northwest to southeast. The west corner is the highest point, and from thence the slope is to the northeast, east, and southeast. In proceeding from the northwest end to the southeast end, the lowest point is encountered at one-quarter the distance across. The bottom of this hollow is fully 20 feet lower than the west corner, and in it no trees appear on an area of about 300 square feet, probably on account of the seedlings being drowned by the water which collects in this pocket during heavy rains.

The largest trees are found between the west corner and the open area in the

hollow, on a distinctly eastern exposure and the steepest slope within the plantation. The poorest trees are found near the southeast end of the plantation, on a northwest exposure. The former trees are at least six feet taller on the average than the latter.

The Jack Pines have proven their adaptation to conditions in the sand

of making a successful growth if planted alone.

FOREST CONDITIONS.

The soil is the characteristic whitish yellow sand of the sand-hill country. The particles are rather smaller than those composing the hills further west, as the plantation is on the eastern border of the sand hills. This results from the tendency of the lighter particles to extend the hills to the southeast, when driven by the prevailing northwest winds.

An examination of the plantation reveals the beginning of genuine forest conditions. No humus appears as yet, but the dense shade has almost killed out the grass, and there is a light ground cover of pine needles. The plantation is really a small forest of poles; the boles of the trees are as well formed and as straight as one would wish to see. The trees have begun to prune themselves, and reproduction is occurring to a limited extent.

There is reason to believe that reproduction has been occurring for a number of years, but that each winter the drifting snow and sand have buried the seedlings of the preceding summer. At least, that has been the fate of many of the seedlings of the past season.

Last July all the seedlings which could be found were staked. December 1, al-

though there had been but one snow, and only a few days of drifting sand, a considerable number of the marked seedlings were found to be completely buried in the sand, which is carried by the northwest wind fully two rods among the trees. It is also true that most of the seedling trees were found in this loose sand, probably because the seed that falls on the loose sand is quickly covered up, and there

hills by making a remarkably thrifty growth, seldom excelled in their native range. The other pines in this plantation have been so outstripped and suppressed by the Jack Pine that it is difficult to say what development they might have attained if they had been grown in a pure stand. The Scotch and Western Yellow Pines, although much slower than the Jack Pine in beginning a satisfactory growth, show some indications



INTERIOR VIEW IN BRUNER BROTHERS' THIRTEEN-YEAR-OLD PINE PLANTATION, SHOWING SIZE ATTAINED.

are few plants or grasses to choke the growth of the seedling.

After a careful examination of the plantation the following operations were decided upon :

1. To caliper all of the trees and tabulate them in 3 classes, as dominant, intermediate, and suppressed.

2. To select average trees from the dominant and intermediate classes, which should serve as a standard in computing the volume of wood in the plantation.

3. To cut out and remove from the plantation all suppressed trees and as many of the intermediate as should be found necessary in order to allow the remaining trees enough room to make a proper development.

The measurements resulted as follows:

Dominant trees = 626, averaging 19.4 feet in height and 3 inches diameter at breast height.

Intermediate trees = 930, averaging 15.9 feet in height and 2.1 inches diameter at breast height.

Suppressed trees = 820, which averaged less than 1 inch in diameter and probably less than 6 feet in height.

Volume of average dominant tree = .56 cubic feet, giving a total volume of 351.1 cubic feet for this class from an annual accretion of 29.2 cubic feet.

Volume of average intermediate tree = .25 cubic feet, giving a total volume of 235.1 cubic feet for this class on an annual accretion of 21.37 cubic feet.

Total volume of wood in the plantation = 586.2 cubic feet.

Total annual accretion = 50.6 cubic feet.

A great many of the suppressed Scotch Pines and a few of the suppressed Western Yellow Pines are apparently quite thrifty, and during the last two or three years have made very satisfactory growth.

Such trees, it was believed, could be profitably transplanted, and with this idea in mind they were left undisturbed. The owners agreed to transplant as many as possible of them during the coming winter, setting them in blanks in deciduous plantations.

Four hundred trees were marked for transplanting, and 568 were marked for cutting and later cut out. Of the latter number 80 per cent were Jack Pine, of which 148 were trees of the intermediate class.

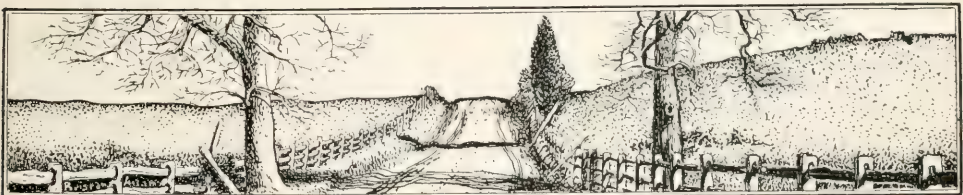
All of the poles cut out were employed in constructing a thatched shed roof. The value of the thinnings for this purpose was estimated at \$5, which fully covered the cost of labor in thinning.

The remaining trees, 1,408 in number, were pruned to a height of 4 or 5 feet. The greater portion of the branches removed were dead, and very few of the living branches were an inch in diameter. Although the number of trees remaining is still very large for the area, the plantation is in excellent condition for a few years of vigorous growth.

The trees are evenly distributed, and the fact that the stand is close will tend to increase the present excellent rate of growth in height, though not, it is believed, to the detriment of increase in diameter.

Three years hence one-third of the remaining trees should be cut out. They will then be large enough to be of considerable value as poles. The survivors will then develop good crowns and increase rapidly in diameter.

A remarkable feature of this plantation is that an unsound or dead tree was not found in the entire number. The twig moth has attacked the Western Yellow Pine and the Scotch Pine to a considerable extent, destroying the terminal buds. In a few instances the Jack Pine has been similarly attacked.





TALES OF A TENDERFOOT.

TOLD BY

ANGUS HEREFORD.

"Then play the fife slowly,
And beat the drum sadly,
And play the Dead March
As ye bear me along.
Take me to the churchyard
And lay the sod o'er me,
For I'm the brave cowboy;
I know I've done wrong."—*Cowboy Song.*

"LOOK out there, son! You'll trip over that there switch. Takin' a little stroll after supper, hey? Well, this North Dakota twilight is hard to beat for pretty, if she is a little cool, and the moon is just a-comin'. Did you and the boss have any luck with the prairie chickens? Well, that was discouragin', for sure; but you try that quarter of wheat stubble up on Section Three about four o'clock tomorrow afternoon, and you'll get all the shootin' you want.

"Jump up here and smoke one of them funny smellin' cigarettes, and I'll tell you a little story. Turkish, you say? No, thanks. I'll stick to Bull Durham a while yet.

"Sure, it's right comfortable up here on the top rail. You better lean back against that post and smoke and hang your laigs off, and I can keep one eye on the corral and look away down the track besides. There's fifty head of

steers in here that I had the boys cut out of the herd this afternoon, and Fifty-Six is due to take 'em East in about an hour. Them three cars on the side track are the ones. They're all bedded down and the racks full of hay. We water 'em jest the last thing, and we don't have to begin to load till we see the headlight comin' out of Dawson. That gives us plenty of time. I'm goin' to take Fred Graves down with me.

"Chicago? Hell! no. Not unless the bottom falls out of the St. Paul market. These cows are only what we call feeders. Some commission-house will buy 'em and then sell 'em again to the grangers down in the corn belt. They may kick around six months yet before they see Armour's.

"The story? Oh, it ain't much of a tale, but the sight of you city boys always reminds me of a tenderfoot we had up here once—two years ago. He was a

sure 'nuff product of the effete East; one of them college cusses, with gig-lamps on his eyes and his hair parted in the middle. He never was on a horse or saw a pair of chaps till he come up here. Consequently his system was plumb loaded down with microbes and his main drink was cod-liver oil and creosote.

"For an hour after he would imbibe that there medicine you'd swear there was a chimney burnt out if you come anywheres near him. He was a pale, slim-built little cuss, and weak as a cat at first, but nothin' would suit him but he must go to work with us boys. That was part of the cure, so the down-east doctor said.

"Well, we found him a horse and a saddle, and he got so he could stick on, part of the time, after a week or so of painful experimentin' in the back corral. Then nothin' would do but he must ride out one day to where the boys was holdin' the herd and show off. When he got about thirty feet from the cattle a jack-rabbit jumps up and the whole blame bunch lit out for the Missouri, jest touchin' the high places. They didn't get much of a start before the boys was alongside trying to turn 'em and get 'em to millin', but poundin' along behind in the dust comes that 'lunger,' boundin' around in the saddle and shriekin', and pullin' all the leather in reach. Of course, the boys couldn't hold the herd as long as he was there. I reckon he wasn't really yearnin' for haste so much, but the cayuse insisted, being well into the spirit of the game, though he was yankin' on the bit all the time.

"This here perverseness on his part got the bronk sort of peevish after a while, and pretty quick she bucked him off, haid first, into a badger hole.

"When the boys come back in the course of twenty minutes there he was, settin' on the ground, a-clawin' the sand out of his ears. Fred made some crack at him about being a pity to lose it, but I reckon the feller didn't hear him, for he never batted an eye. His troubles was too distractin' just then. Always after that he acted grieved over that stampede, because the boys 'lowed the

herd must have smelt them creosote cock-tails an' took it for a prairie fire comin'.

"Then about five or six months later, along in the fall, I give him a touch of high life one Sunday afternoon that he'll never forget—nor me neither.

"We'd been duckshootin' on the passes below Dawson, and were clippin' along for the ranch in a light buggy, behind a light pair of bays that we used for runnin' coyotes in the winter. They sure enjoyed a chase as much as me, and that means a whole lot.

"About three miles from home a coyote showed up, and the horses saw him as quick as I did. The prairie was nice and level, and there wasn't any fences around to bother, so I pulled the team around a little and began to circle the wolf, who was settin' up on his haunches watchin' our movements with a heap of interest. We were gettin' closer and closer, and when we were about 200 yards away, the wolf dropped on all-fours and started. I whistled to the team, and we were all off in a bunch with the wind buzzin' in our ears and the runnin' gear jumpin' up and down over the hummocks. The box rides more steady, that-a-way, than you would think for; the springs takes most of the jar. The team was stretchin' out like a pair of scared jack-rabbits, but steady and wise as old plugs.

"The tenderfoot's hat blew off the first jump, and I see him, out of the tail of my eye, clingin' fast for dear life, and lookin' out mighty mournful for a soft place to light on. But pretty quick, gettin' more used to the situation, he grabbed his scatter-gun, dumped out the sixes, and shoved in some BB's that he carried in his upper pocket.

"We were travellin' three feet to the coyote's two, and in the course of a mile we'd pulled up on him so that he were only about thirty yards away, right down in front of the team. The Eastern guy couldn't shoot for fear of hittin' the horses, and I didn't dare swing aside, goin' at that rate, for fear of throwin' 'em. So we held straight ahead, and, try as he would, old Mr. Wolf couldn't gain an inch. If I'd only took the hounds with us, they would have caught him too easy.

"All to once, here goes the wolf straight down a long hill, and we tight behind him. It wasn't no use for me to try to pull the team in, so I just steadied them as good as I could, and Lordy, Lordy, how we did fly!

"Down in the bottom of the valley you could see by the looks it was marshy ground, all sort of coarse grass, dead, and trampled down in spots, and I suppose I could by good drivin' have pulled a little to the left and gone round the end of the slough, where the side hill would have kept us from upsettin', like a banked corner on a race track.

"But the wolf went straight across, in course, and I sort of hated to discourage the horses, they was doin' so good; so I put 'em straight at it—thirty mile an hour, and hopin' for the best.

"That was where I made a misplay, you bet. My confidence in that there star-spangled slough was entirely misplaced.

"There came one big slam-bang, somethin' like gettin' kicked to death and shot both to once, and there was me and the tender-foot strung out half way across the slough and peacefully reposin' on the horses' backs, him with the gun still in his hands, loaded and cocked.

"Tom and Jerry was mired down up to their bellies, and a-lyin' there pantin' and a-waitin' for us to help 'em.

"In leavin' the buggy we had took the dashboard along with us, on our knees, and both bits and one neck-yoke strap was broke. But we got the horses up and managed to get home by usin' some rawhide and a cartridge belt to patch with.

"The coyote? Oh, he just run up the further hill and sat down and laffed at us, in easy rifle shot; but we got even with him and all his family the next winter—the sweet-scented, hind-legged, long-haired, golden-eyed subject for blasphemy!

"And now, if you don't mind, I *will* smoke one of them joss-sticks of yourn. I don't seem to have no more papers here, someway. Thanks. Hear that whistle? Train must be this side of Steele.

"I was goin' to say there was one

more thing that feller did that was plumb redic'lous. I happened to be standin' over on the depot platform when it happened, and I laffed till I was weak.

"This was after he had been here a year. He had quit that there degenerate creosote habit by that time, and took to our kind of clothes, and was growin' right brown and tough. One evenin' in May or June, just after supper, he had went over southeast a piece to shut off the windmill on Section 9. He was ridin' a little blue mare that he had named after some girl down East what used to worry him a heap, and he had a .22 Winchester along in a saddle scabbard.

"As he got back down below the depot where the road runs alongside the track a ways, No. 1 pulls in from the east, runnin' slow on account of some work the section gang was doin' on the track west of town.

"One after another the Pullmans come slidin' past him, all loaded down with tourists and such like. On the hind end of the observation car there was a whole bunch of eastern girls a-viewin' the glories of the country, and when they sees this feller with his chaps and broad hat amblin' along on Flirt, they all makes passes at him with they hankachifs quite vivacious and frequent.

"He swings off his hat and bows very low, and then sticks in the spurs and begins to burn up the road, tryin' to stay with the game.

"When he comes to the crossin' below the depot, 'stead of goin' across to the hotel, he turns in between the rails and tries to cut down the lead some more. It seems like he aims to ketch up with the train and shake hands with some of them misguided young females before he reaches the crossin' here by the stock chutes. The girls was laffin' and squealin' and wavin' at him, and for twenty rod or so it went all right and lovely.

"Then the pony must have took offense at the rough goin', or the noise of the train, or mebbe at the big red-and-black N. P. sign on the hind rail, for all of a sudden I see her set her

front laigs and go to pitchin' to beat perdition.

"The first time he lit on the horn, and the next time behind the saddle. The third time he was doing a somerset from the aide of the bank into the borrow-pit, and Flirt was doin' buck jumps on the way to the stable, with them heartless eastern wimmen all doubled up and a-hangin' on to each other!

"The hero of all these doin's acted consid'ble morose for a week, 'specially as Dr. Morris come in here next mornin' and left a note for him that them girls had wrote and sent back to him while the train was takin' water at Dawson. They described him to the station agent, and there warn't no mistakin' him. We took the letter away from him, and we all learnt what was in it to josh him with. But he turned a .30 carbine loose on Louis Stevens' heels one afternoon and we concloded that he was absorbin' Dakota ways fast enough not to merit

the name of tenderfoot no longer. That letter was all in poetry like this:

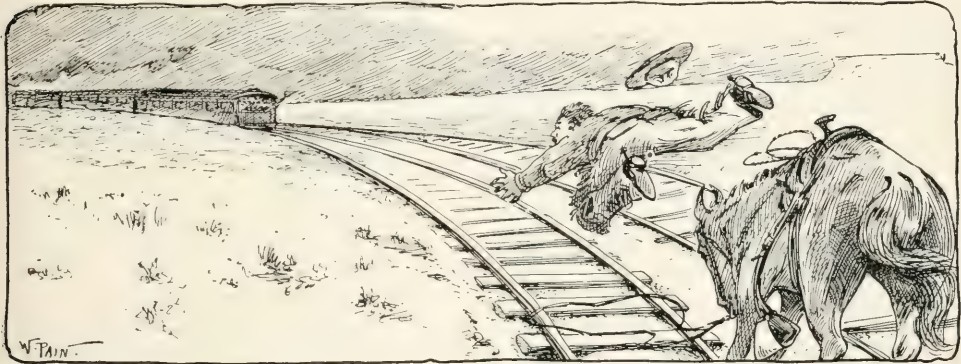
O gallant horseman of the plains,
O nameless mister,
We thank you for your courteous pains,
We'd just been reading Owen Wister.

So when you popped upon our view
So unexpected,
We jumped with glee to think in you
We'd the Virginian detected.

We'd settle for the Wild-West show
We had while goin',
But really can't until we know
How much is *Owen*.

And also (we're compelled to ask
In mild hysteria),
If that last lovely grapevine twist you did
Was a *Wister*-ia?

"Well, there's Fifty-six's headlight, just pullin' out of Dawson! Would you mind to step over to the house and tell Clyde to bring that other pinch-bar and my slicker and another lantern? I'll get the boys and we'll load right away."



NATIONAL BOARD OF TRADE.

COMMITTEE REPORT AND RESOLUTIONS ON FORESTRY AND IRRIGATION, PRESENTED AT THE THIRTY-FIFTH ANNUAL MEETING, HELD AT WASHINGTON, D. C., JANUARY 21, 1904.

THE reclamation and settlement of the arid region through the construction of great reservoirs and irrigation works by the national government became an established national policy by the passage of the National Irrigation Law, enacted June 17, 1902.

This law was the fruition of a broad national campaign of education which

brought to the attention of the people of the entire United States the immense national advantages which would result from the storage, for beneficial use, of the flood waters which now run to waste in our western rivers.

It is of interest and worthy of note at this time that the National Board of Trade was the first national organiza-

tion representing the commercial interests of the whole country, to take up for serious consideration and to recommend as a national policy the construction of national reservoirs for the storage of water for irrigation and other purposes.

At the 28th annual meeting of the National Board of Trade in December, 1897, after a very interesting general discussion of the subject, the following resolution was adopted:

"Whereas, the matter of using a system of artificial irrigation for securing crops and making available arid and unproductive lands has assumed a national character, and is of vital interest to every section of our common country, opening, as it does, settlement and homes for millions of people an area equal to one-third of the United States; and as the storage of water necessary for this purpose involves the question of injury or benefit to navigable streams, it is

"Resolved, by the National Board of Trade, That while it looks with favor upon a system which promises so much for the future increased productiveness of our country, we recommend Congress to enact measures which shall look to the preservation of the navigable streams of the country, and which shall also provide for the supervision and direction of all irrigation enterprises in the hands of the United States authorities, where such work is undertaken upon waterways affecting interstate navigation."

And a Committee on Irrigation was appointed, with the following members:

George H. Anderson, chairman, Pittsburg; Wm. B. Ebersole, Cincinnati; E. O. Stannard, St. Louis; B. A. Eckhart, Chicago; J. H. Lafaye, New Orleans.

At the 29th annual meeting of the National Board of Trade in December, 1898, the report of the Committee on Irrigation and Storage of Flood Waters was presented and read to the board by Mr. George H. Anderson, of Pittsburg, the chairman of the committee, and was accompanied by a comprehensive engineer's report on the subject, made by Mr. J. P. Frizell, of Boston.

The foregoing reports, with the discussion thereon and the resolution adopted, appear in the proceedings of the 29th annual meeting of the National Board of Trade, pages 60 to 76, and are immediately followed by comprehensive resolutions for the preservation of the forests as sources of supply for forest products, and for the favorable influence of forest lands on climatic conditions affecting the sanitary welfare and the water supply of the country.

We feel that it is a matter upon which the National Board of Trade may well be congratulated that it should at this early date have been instrumental in calling the attention of the country to these two great national questions which have since had such a development.

As the campaign for reservoirs progressed it became each year more manifest that the foundation upon which a national policy of water storage must be based was the adoption of and faithful adherence to a public land policy under which the remaining public lands should be reserved for actual settlers only.

This point was strongly brought out in the report of the standing committee and the resolutions of this board, at its 32d annual session in January, 1902.

In that report, on page 160 of the proceedings of that meeting, it was said:

"Two essentials, however, lie at the foundation:

"First. The preservation of the forests, which are the sources of the water supplies in the arid region; and

"Second. The reservation of the land for actual settlers under the Homestead Act.

"Trade and commerce will increase as population increases, and our whole land policy should be framed to preserve the public lands for those who will build homes upon them. This is of the most vital importance."

Among the resolutions then adopted was the following:

"Resolved, That all lands under said system should be reserved for actual settlers, under the Homestead Act, and that neither the public lands nor the control of their reclamation should in any way be surrendered to the states;

and that the Desert Land Act should, as recommended by the Secretary of Agriculture, be repealed; and, also, that the commutation clause of the Homestead Act should be repealed."

This was in January, 1902.

In the following June, the National Irrigation Act was passed, and that act did provide, in conformity with the principle set forth in the foregoing resolutions, that the lands to be reclaimed under it should be reserved for actual settlers under the Homestead Act, and that the control of their reclamation should be wholly retained by the national government.

These provisions of that law were, however, only secured in the face of the most strenuous opposition from the influences which are now opposing the further reforms in the land laws which are advocated by this organization.

In its resolutions at the said meeting of this board in January, 1902, it urged upon the Congress an increase of the hydrographic appropriation of the U. S. Geological Survey to \$250,000, and the construction of three national irrigation systems—one in Arizona, one in Nevada, and one in Montana.

These recommendations have so far been carried into effect that the hydrographic appropriation above referred to has been increased from \$100,000 to \$200,000. The large sums made available by the National Irrigation Act for preliminary surveys thereunder have made a further increase of said hydrographic appropriation, for the time being at least, unnecessary.

IRRIGATION PROJECTS UNDER WAY.

Under the National Irrigation Act the construction of the Tonto Basin Reservoir in Arizona, the Truckee-Carson project in Nevada, and the Milk River project in Montana have been approved by the Secretary of the Interior, and the work of construction is actually under way in Arizona and Nevada.

The Tonto Basin Reservoir in Arizona will be formed by the construction of a dam on Salt River, which will be one of the largest dams in the world. It will rise 250 feet above the channel of the stream, its thickness at the base will be

188 feet, gradually tapering to a width of 16 feet at the curb, and its width across the canyon will be 800 feet. The cost of the structure will be about \$3,000,000, and the storage capacity of the reservoir will be about a million and a half acre-feet—a reservoir far larger than that formed by either the great Croton Dam or the Wachusett Dam.

The contract has been let for the construction of a canal in Nevada amounting to about a million dollars, which will take the flood waters of the Truckee River across the divide for storage in a reservoir on the Carson River, to be used for the irrigation of lands lower down in the Carson Valley.

The surveyors and engineers have been at work for several years making the surveys and preparing plans and estimates of cost of the Milk River project in Montana. A discussion of this enterprise by Cyrus C. Babb, engineer, Geological Survey, is published in the January number of FORESTRY AND IRRIGATION. The suggestion is made in this article that the waters stored in St. Mary Lakes might be allowed to run into Canada and then back into the United States through the Milk River, for use in the Milk River Valley below. We believe that this would be a most unsafe and unwise plan, and urge the construction of a system of works which will confine these waters at all times within the territory of the United States under one of the plans suggested in said article. We also urge that the work of construction should be begun without delay on the Milk River system, as soon as the necessary plans and estimates of the cost have been completed and approved by the United States Reclamation Service.

As soon as the work of construction on this project begins, all the recommendations of the aforesaid resolution of the National Board of Trade will have been carried into effect by the government.

TO SAVE THE PUBLIC LANDS.

The resolutions of this organization, adopted at its said meeting in January, 1902, urging upon Congress that the Desert Land Act and the commutation clause of the Homestead Act should be

repealed, have not been acted upon by Congress.

These resolutions were reiterated and emphasized by this board at its following annual meeting in 1903.

The President of the United States, in his message to Congress in December, 1902, made the following recommendation:

"So far as they are available for agriculture, and to whatever extent they may be reclaimed under the National Irrigation Law, the remaining public lands should be held rigidly for the homebuilder, the settler who lives on his land, and for no one else. In their actual use the Desert Land Law, the Timber and Stone Law, and the commutation clause of the Homestead Law have been so perverted from the intention with which they were enacted as to permit the acquisition of large areas of the public domain for others than actual settlers, and the consequent prevention of settlement."

Thereafter a bill was introduced in the House by Representative Powers, of Massachusetts, and one in the Senate by Senator Quarles, of Wisconsin, which carried out the recommendations of the President by providing for the repeal of the objectionable laws above named. The Public Lands Committee of the House was unwilling to report favorably the Powers bill, but the Public Lands Committee of the Senate did report for passage the Quarles bill, and a copy of such report is attached to this report of your committee, and we ask that it be made a part hereof and published in the proceedings of this Board.

The facts set forth in this report (57th Cong., 2d session, Rep. 3166) show beyond all possibility of doubt that the recommendations of this organization and of the President of the United States should be immediately carried into effect by the repeal of the three laws above named.

Their repeal has been urged by the Trans-Mississippi Commercial Congress at its session in Seattle, Washington, in October, 1903; by the National Business League of Chicago, the National Association of Agricultural Implement and Vehicle Manufacturers, the Na-

tional Irrigation Association, the American Hardware Manufacturers' Association, the National Grange, and various other organizations throughout the country.

The opposition to the repeal of these laws comes from interests which are profiting by the rapid absorption of the public lands into private ownership, which is going on to-day at an appalling rate.

RAPID ABSORPTION OF LANDS.

The rapidity with which these lands are being taken up is a menace to the entire national irrigation policy and to the development of the internal trade and commerce of the United States, which must have its source in increased population in the arid region. In the last two years 42,139,463 acres have disappeared from the public domain, and have been acquired largely by speculators and syndicates and livestock corporations, with practically no corresponding increase in the population.

The present land policy of the United States is resulting in an actual money loss to the government of many millions of dollars annually, and the attention of our law-makers in Congress should be urgently called to the fact, that, while they are aiming at economy in the expenditure of money, they are permitting laws to remain upon the statute books under which absolutely the most valuable asset of the government is being recklessly wasted. The Commissioner of the General Land Office, in his report, is officially responsible for the statement that over \$130,000,000 worth of timber land has been sold for \$13,000,000—a loss of over \$100,000,000 to the government, and this loss is still continuing at an increasing rate.

The astounding rapidity in the increase of the disposals of the public domain is shown by the following figures:

Year.	Acres.
1898.....	8,453,896
1899.....	9,182,413
1900.....	13,453,887
1901.....	15,562,796
1902.....	19,488,535
1903.....	22,824,299
Total	88,965,826

Notwithstanding the facts above stated, as set forth with much additional conclusive evidence in the report of the Senate Lands Committee recommending for passage the Quarles bill in the last session, no action whatever was taken by Congress before adjournment.

In his last annual message to Congress, President Roosevelt called attention to the land frauds existing in the following strong terms:

"By various frauds and by forgeries and perjuries, thousands of acres of the public domain, embracing lands of different character, and extending to various sections of the country, have been dishonestly acquired. It is hardly necessary to urge the importance of recovering these dishonest acquisitions, stolen from the people, and of promptly and duly punishing the offenders."

REMEDY FOR THE EVIL.

We must not lose sight of the fact, however, that it is a poor policy to lock the stable door after the horse has been stolen, and it is very doubtful whether any material part of the public domain which has been fraudulently located and patented will ever be recovered by the government. The thing to do is to stop these frauds by repealing the laws under which they are permitted, and thereby close the stable door against future thefts.

The President, in his message, further said:

"The rapidly increasing rate of disposal of the public lands is not followed by a corresponding increase in home-building. There is a tendency to mass in large holdings public land, especially timber and grazing lands, and thereby to retard settlement. I renew and emphasize my recommendation of last year that, so far as they are available for agriculture in its broadest sense, and to whatever extent they may be reclaimed under the national irrigation law, the remaining public lands should be held rigidly for the home-builder. The attention of Congress is especially directed to the Timber and Stone Law, the Desert Land Law, and the commutation clause of the Homestead Law, which have in their operation in many re-

spects conflicted with wise public land policy."

To this end the same bill introduced by Senator Quarles in the last session of Congress and favorably reported by the Senate Public Lands Committee has been reintroduced by him at this session, and we most earnestly recommend that Congress be urged to recognize the importance to the people of this country, and especially to the commercial and manufacturing interests, of the immediate passage of this bill. The facts which show the urgent and immediate need for the repeal of these laws are notorious throughout the country and have been again and again laid before Congress by President Roosevelt and other Presidents of the United States, Secretaries of the Interior and of Agriculture, and Commissioners of the General Land Office. Every month of delay results in the disappearance from the public domain of a body of land now aggregating more than two million acres a month, and the rate of such absorption is steadily increasing.

Realizing that public sentiment is demanding some action on this question, various substitutes and amendments to these laws have been introduced in Congress, in the hopes of diverting attention from the main issue and in securing a wordy revision of the land laws, which, however, will still leave them convenient tools for the land-absorbing interests.

DANGER IN LAND GRANTS TO STATES.

There are many reforms which should be made in our land system in addition to the repeal of the three laws above referred to. There are bills pending in this session of Congress for the cession of lands to certain states and territories for various purposes, without any designation of the specific lands desired granted. Before another acre of public land is granted to any state or territory for any purpose whatsoever, or upon any terms and conditions whatsoever, a thorough investigation should be made and a report laid before Congress and the people of the country as to what has been done by the states and territories of the arid and semi-arid region with

the public lands heretofore granted to them, aggregating a vast extent of territory, and what use has been made of the proceeds derived from that source by the states and territories. It is a notorious fact that in the arid region state lands are acquired by speculators or those who desire to monopolize the waters of the country in order to control the surrounding lands, by obtaining these state land grants and locating them in such a way in strips along the streams and around lakes and ponds as to prevent settlers from reaching or using the water, thereby condemning vast territories to remain uninhabitable, because, in the manner above referred to, control of the water has been obtained through improvident grants of land to the states by Congress. It matters not how meritorious the ostensible purpose of such a grant may be; it should not be made if it is to be left to the state or territorial officials to select the land. It makes it possible to so locate a comparatively trifling area of land as to destroy the value for settlement purposes of millions of acres of land remaining the property of the national government.

The inauguration of the new national policy with reference to the public lands embodied in the National Irrigation Act, and for several years advocated in the resolutions of this board, makes it unwise and inadvisable that any more lieu land scrip or lieu land exchange rights of any kind or nature should ever be issued or created, and all such scrip or rights now existing should be immediately and finally adjusted by location or otherwise.

It is equally important that the immediate selection and location or retirement of all state land grants should be required by the national government.

Every floating land right of whatever nature or kind should be eliminated from the situation with reference to the public lands, and this should be done without delay. The existence of any of these floating rights is a menace to any wise public land policy.

The greatest evils which have arisen under the system of lieu land scrip authorized by existing laws have been in

the location of valuable forest lands with such scrip. This evil should be immediately stopped by the inclusion of all forest lands in forest reserves, as is urged in the resolution proposed to this board by the Chicago Board of Trade and recommended by your committee for adoption by this board at this meeting. If our forest resources are to be perpetuated by right use and the sources of our water supplies preserved, the ownership and control of the forests must be retained by the national government, and they should not be allowed to pass into private ownership and control, either through the location of lieu land scrip or lieu land exchange rights of any class or kind, or by location under any land law or state land grant made by the Congress of the United States.

PROGRESS IN FORESTRY.

On the subject of forestry this organization is likewise to be congratulated upon the progress which has been made from year to year since it extended its influence in aid of the forestry movement.

In the resolutions adopted by the National Board January, 1902, it urged upon Congress a concentration of the forestry work of the national government—

“Under a single head, in accordance with plain business principles and common sense.”

This was in conformity with the recommendation of President Roosevelt in his first message to Congress, a recommendation which was renewed in his last annual message to Congress; but as yet no action has been taken by Congress to carry these recommendations into effect. This recommendation was reiterated in the last year's resolutions of the National Board of Trade.

A bill has been reported from the Committee on Public Lands of the House of Representatives, carrying this policy into effect and placing the entire forestry work of the government in the Bureau of Forestry of the Department of Agriculture. The report referred to is H. R. Rep. 48, Fifty-eighth Congress, second session, to accompany H. R.

8460. The bill is printed in full in the report, and it specifically carries into effect the recommendations of the President, and is approved by the Commissioner of the General Land Office and the Secretary of the Interior, and has received a favorable report from the Committee on Public Lands of the House.

The passage of this bill will carry into effect the recommendation of this board, and the committee recommends that it earnestly urge upon Congress its immediate passage.

We submit, as a part of this report, and recommend for adoption by this board, the following resolutions:

RESOLUTIONS.

Whereas, the ultimate object to be accomplished in the disposition of the public domain is to secure the actual settlement and cultivation of the largest possible area of such lands to agricultural crops, by a class of settlers who will actually live on said lands and till them in comparatively small farms, thus enlarging to the utmost the agricultural production, and consequent general prosperity of the country; and

Whereas, the rapid absorption of these public lands into large holdings, under the Desert Land Act and the commutation clause of the Homestead Act, unaccompanied in the majority of cases by permanent settlement and cultivation, threatens to seriously retard the development of the West, and the abuses and frauds which have been committed under these laws and under the Timber and Stone Act can only be prevented by a repeal of those laws: be it

Resolved, That the Timber and Stone Act, the Desert Land Act, and the commutation clause of the Homestead Act should be forthwith repealed, and in future all agricultural and irrigable land reserved exclusively for actual settlers under the Homestead Act, and that in future the government should reserve the title to forest lands, selling only the stumpage of matured timber; and also that the forest work of the government should be consolidated in the Bureau of Forestry of the Department of Agriculture.

Resolved further, That the great irriga-

tion works necessary to save from waste and utilize for irrigation the waters of our large western rivers should be built as rapidly as the lands will be taken and utilized by farmers in farms of 160 acres or less in area, and the entire cost of construction repaid to the government through a charge imposed on the lands reclaimed, as provided in the National Irrigation Act.

Resolved further, That we endorse and approve the selection by the United States Reclamation Service and the Secretary of the Interior, for construction under the National Irrigation Act, of the Tonto Basin Reservoir in Arizona, the Truckee-Carson River System in Nevada, and the St. Mary-Milk River Valley System in Montana, and urge that the actual work of construction on all these projects be pushed to completion without delay.

Resolved further, That we endorse and urge the immediate passage of H. R. 8460, being the bill embodied in House of Representatives Report No. 48, Fifty-eighth Congress, second session, the said bill as shown in said report having been approved by the Commissioner of the General Land Office and the Secretary of the Interior, and recommended for passage by the Committee on Public Lands of the House of Representatives.

Resolved further, That we endorse the Quarles bill as recommended for passage in the report of the Senate Committee on Public Lands at the last session of Congress, and reintroduced in this session, being Senate Bill 932, Fifty-eighth Congress, first session, and urge the immediate passage of said bill in this session of Congress, in order that the monstrous abuses and frauds which have been and are now being committed under the acts therein mentioned shall be forthwith stopped; and that we call the attention of Congress and of the country to the facts set forth in said Senate report, which show the urgent need for the immediate repeal of said laws, said report being known as part 1 of Report 3166, Fifty-seventh Congress, second session.

Resolved further, That no laws should at any time or under any circumstances be enacted by Congress which would permit any one to acquire title to public

lands, except as an actual settler, who had lived five years on the land, as required by the original Homestead Act, and that no grant of public lands should ever be made to any state or territory for any purpose whatsoever, and that there should be no extension of the provisions of the Carey Act.

Resolved further, That we urge upon Congress the prompt enactment of a measure which will compel the immediate location or retirement of all lieu lands scrip of every description, and that no more such scrip shall ever be issued.

Resolved further, That the secretary of this board be, and he is hereby, instructed to immediately transmit a copy of the foregoing resolutions to the President of the United States, and to every Senator and Representative in Congress, and also to every organization which is a member of this board, and request their earnest coöperation to secure the passage of the bills above referred to,

and to the enactment of all legislation necessary to carry these resolutions into effect.

Resolved further, That the Committee on Forestry and Irrigation of this board be continued, to coöperate with the secretary and commissioner of this board in carrying into effect the foregoing resolutions, and to report to the next annual meeting of this board, and that the said committee be composed of all members of the last committee of this board on Forestry and Irrigation and of this committee who have attended this annual meeting, being the following-named persons: William H. Chadwick, F. B. Thurber, F. L. Hitchcock, George H. Anderson, R. S. Lyon, George H. Maxwell.

Respectfully submitted.

R. S. LYON.

GEORGE H. MAXWELL.

(Unanimously adopted.)

FORESTRY AND IRRIGATION IN CONGRESS

A BULLETIN OF NATIONAL LEGISLATIVE MEASURES CONCERNING FORESTRY, IRRIGATION, AND THE DISPOSAL OF THE PUBLIC LANDS, FIFTY-EIGHTH CONGRESS, SECOND SESSION.

January 4, 1904.

In the Senate: Mr. Nelson presented a petition of the Southwestern Lumbermen's Association, praying for the enactment of legislation to enlarge the powers of the Interstate Commerce Commission.

Mr. Cockrell, at the instance of the Southwestern Lumbermen's Association, introduced a bill (S. 2860) to further amend "An act to amend an act approved January 21, 1903, entitled 'An act to amend an act entitled 'An act to provide for the use of timber and stone for domestic and industrial purposes in the Indian Territory,''" approved June 6, 1900."

Mr. Mitchell introduced a bill (S. 2993) to amend the first section of an act entitled "An act authorizing the citizens of Colorado, Nevada, and the territories to fell and remove timber on the

public domain for mining and domestic purposes," approved June 3, 1878.

Mr. Burton introduced a bill (S. 2980) authorizing the taxation of arid public lands under certain conditions for the purpose of settlement and reclamation.

Mr. Hansbrough introduced a bill (S. 3004) providing for the appointment of a supervising engineer who shall have immediate charge of all construction work under the act of June 17, 1902, entitled "An act appropriating the receipts from the sale and disposal of public lands in certain states and territories to the construction of irrigation works for the reclamation of arid lands."

In the House: Mr. Mondell introduced a bill (H. R. 8684) to extend by ten years the time for the selection and segregation of public lands provided for by section 4 of the act entitled "An act making appropriations for sundry civil

expenses of the government for the fiscal year ending June 30, 1895, and for other purposes."

Also a bill (S. 2994) to amend an act entitled "An act authorizing the citizens of Colorado, Nevada, and the territories to fell and remove timber on the public domain for mining and domestic purposes," approved June 3, 1878, so that the provisions of said act shall be extended to and include the States of Oregon, Washington, and California.

In the House: By Mr. Mondell: A bill (H. R. 8682) granting to railroads and water companies the right of way through public lands and reservations of the United States for reservoirs and pipe lines.

By Mr. Lacey: A resolution of the Massachusetts Forestry Association favoring the preservation of the Big Trees in California.

January 5.

In the Senate: Mr. Mitchell introduced a bill (S. 3036) for the protection of the Bull Run Forest Reserve and the sources of the water supply of the city of Portland, State of Oregon.

In the House: By Mr. Mondell: A bill (H. R. 8868) to apply a portion of the proceeds of sales of public lands to the endowment of schools or departments of mines and mining in connection with the colleges established in the several states under the provisions of an act approved July 2, 1862, entitled "An act donating public lands to the several states and territories which may provide colleges for the benefit of agriculture and the mechanic arts and for similar purposes."

By Mr. Gillett, of California: A bill (H. R. 8893) to provide for the examination and classification of certain lands in the State of California.

January 6.

In the Senate: Mr. Hansbrough presented a petition of the American Forestry Association, praying that an appropriation be made for the improvement and construction of roads and trails within the national forest reserves.

In the House: Mr. Lacey called up the bill (H. R. 8460) providing for the transfer of the forest reserves from the Department of the Interior to the Department of Agriculture, but upon the request of Mr. Hemenway the bill was allowed to go over.

January 7.

In the Senate: Mr. Stewart introduced a bill (S. 3133) to restore to the public domain a portion of the Gila River Indian Reservation, in the Territory of Arizona, and for other purposes.

Mr. Dubois introduced a bill (S. 3165) amending section 3 of the act of June 5, 1900.

January 8.

In the Senate: A message from the House announced that the House had passed a bill (H. R. 9160) to amend an act entitled "An act making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1904," approved March 3, 1903, in which it requested the concurrence of the Senate.

In the House: By Mr. Smith, of Texas: A bill (H. R. 9300) to authorize the Secretary of Agriculture to make experiments in irrigation in the semi-arid regions of the State of Texas, and to make appropriations therefor.

By Mr. Gillett, of California: A bill (H. R. 9310) to exclude from the Yosemite National Park certain lands therein described, and to attach to and include said lands in the Sierra Forest Reserve.

By Mr. Lacey: A bill (H. R. 9321) to authorize the Secretary of the Interior to acquire for the Government, by exchanges of public lands, the ownership of the private lands within certain public parks in the State of California.

A similar bill was introduced in the Senate (S. 3376) January 13 by Mr. Bard.

January 13.

In the House: By Mr. Sperry: A resolution of the New Haven and Coastwise Lumber Dealers' Association in favor of a bill to establish a forest reserve in the White Mountains.

In the Senate: Mr. Clapp submitted

an amendment authorizing the Chippewa Indians of Minnesota to dispose of the timber on their respective allotments, intended to be proposed by him to the Indian appropriation bill.

January 14.

In the House: By Mr. Robinson, of Indiana: A bill (H. R. 10010) to provide for the union of Oklahoma and the Indian Territory as one state, and to enable the people thereof to form a constitution and state government, and to be admitted within the Union as the State of Oklahoma on an equal footing with the original states, and to make donations of public lands to said state.

January 15.

In the Senate: A message from the House announced that, among others, the Speaker had signed the following enrolled bill, which was thereupon signed by the President *pro tempore*:

A bill (H. R. 9610) to amend an act entitled "An act making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1904," approved March 3, 1903.

Mr. Burton presented a petition of sundry citizens of Rocky Comfort, Mo., praying for the repeal of the present homestead law.

Mr. Latimer introduced a bill (S. 3477) to establish in the Department of Agriculture a bureau to be known as the Bureau of Public Highways, and to provide for national aid in the improvement of such highways.

The President *pro tempore* laid before the Senate a petition asking the aid of the President of the United States in preserving the Calaveras groves of big trees, accompanied by a message from President Roosevelt, cordially recommending said petition to the favorable consideration of the Congress.

January 18.

In the Senate: Mr. Hansbrough introduced a bill (S. 3546) relating to proofs under the homestead laws, and to confirm such proofs in certain cases when made outside of the land district within which the land is situated.

In the House: By Mr. Needham: A bill (H. R. 10144) to amend an act en-

titled "An act for the relief of certain settlers on the public lands, and to provide for the repayment of certain fees, purchase-money, and commissions paid on void entries of public lands."

By Mr. Adams, of Pennsylvania: A petition of the Calaveras Big Tree Committee of San Francisco, Cal., in favor of a bill for the protection of the Calaveras groves.

Also by Mr. Hill: A resolution of the Connecticut Horticultural Society of Hartford, Conn., relative to the preservation of the big trees of California.

January 19.

In the Senate: Mr. Clapp submitted an amendment intended to be proposed by him to the bill (S. 3546) relating to proofs under the homestead laws, and to confirm such proofs in certain cases when made outside the land district within which the land is situated.

Mr. Nelson secured consideration of the bill (S. 1558) granting two designated forties of the public lands to the State of Minnesota for forestry purposes, which was passed.

Mr. Hansbrough secured consideration of the bill (S. 371) granting to the State of North Dakota 30,000 acres of the public lands to aid in the maintenance of a school of forestry, which was passed.

In the House: President Roosevelt's message in regard to the Calaveras grove of big trees and the accompanying petition from the Calaveras Big Tree Committee were laid before the House as previously before the Senate.

By Mr. Lacey: A bill (H. R. 10433) authorizing the Commissioner of the General Land Office to quitclaim the title conveyed to the United States for land in forest reservations under certain conditions.

Also a resolution of the New York Zoölogical Society relative to the preservation of the big trees of California.

By Mr. Sullivan, of New York: A petition of the Outdoor Art League of San Francisco relative to the big trees of California.

January 20.

In the House: By Mr. Daniels: A resolution of the Pioneers of Los An-

geles County in favor of preserving the big trees of California.

Also a resolution of the San Francisco Chamber of Commerce favoring the purchase of the Calaveras big trees.

January 21.

In the House: Mr. Mondell, from the Committee on the Public Lands, to which was referred the bill of the House (H. R. 4866) prohibiting the selection of timber lands in lieu of lands in forest reserves, reported the same with amendment, accompanied by a report (No. 445); which said bill and report were delivered to the Clerk and referred to the House Calendar.

By Mr. Shackelford: A bill (H. R. 10759) for the purchase of a national forest reserve along the Niangua River, to be known as the National Niangua Forest Reserve.

The following petitions were laid on the clerk's desk:

By the Speaker: A memorial of the faculty of Michigan Agricultural College relating to the preservation of the big trees of California.

By Mr. Gardner, of New Jersey: A petition of the Outdoor Art League relating to the preservation of the big trees of California.

January 22.

In the House: Mr. Emerich laid upon the clerk's desk a resolution of the Amalgamated Woodworkers' International Local Union, No. 7, of Chicago, favoring the repeal of the desert-land law.

Also a similar petition from local union No. 135, Amalgamated Meat Cutters and Butchers of North America.

RECENT PUBLICATIONS.

Any of these books will be sent by the publishers of "Forestry and Irrigation," postpaid, to any address on receipt of the published price, with postage added when the price is marked "net."

U. S. Department of Agriculture. Field Operations of the Bureau of Soils. 1902. Fourth Report. 839 pp., 60 plates, 25 figures, 44 maps (in separate portfolio case).

In a general review of the work of the year Milton Whitney, Chief of the Bureau, states that the organization of the Bureau remains the same as during the preceding year. Fifteen soil survey parties have been maintained during most of the year.

The work in the United States proper has been in charge of Thomas H. Means, while that in the insular possessions has been directed by Clarence W. Dorsey. In the latter part of the year Mr. Means was, at his own request, placed in charge of the alkali reclamation work, which is giving such promise of large returns in successful agriculture.

As an illustration of the rapid progress of the work of this important Bureau, it may be said that previous to the field season of 1902 the entire area mapped by its experts amounted to 15,900 square miles. During the single year covered by the present report the area mapped was 18,000 square miles, embracing 36 areas in 26 states and territories and Porto Rico. The expense of these surveys averages 33 cents per 100 acres.

The body of the report is taken up with descriptions of the work done on the several areas examined, explanations of the problems arising, and the deductions and recommendations of the soil experts.

Irrigators should feel interest in the advice

for treatment of alkali in soils and the discussions of underground and seepage waters and general reclamation in the arid and semi-arid states.

Seventh Report, Forest, Fish, and Game Commission, State of New York. J. B. Lyon Co., State Printers. Albany, N. Y.

This volume is one which should be found in the library of every forester. It is quite the handsomest and most elaborate publication of its kind that has ever come to the notice of this office, the only point which could be unfavorably commented upon being the binding, which is not up to the standard set by the rest of the book. There are 534 pages, embellished with many remarkably handsome colored plates by Oliver Kemp, Louis Agassiz Fuertes, L. H. Joutel, and others, in addition to black and white illustrations.

A large portion, at least, of the material of this report has already been published, some of which, as the Annual Report of the Forest, Fish, and Game Commission, has received previous mention in this column.

But it has never been presented before in such attractive guise and under one cover. In addition to the routine reports of the Commission, ten articles are presented, all of which are interesting to the sportsman and the forester, and some of which are of high technical value. Here is the list:

The St. Lawrence Reservation, Arthur B. Strough.

Chestnut Culture in the Northeastern United States, E. A. Sterling.

The Economic Value of Birds to the State, Frank M. Chapman.

Tree Planting on Streets and Highways, William F. Fox.

Moose, Madison Grant.

The Wapiti, W. A. Wadsworth.

The Adirondack Black Bear, George Cha-hoon.

Food and Game Fishes of New York, Tarle-ton H. Bean.

The Future Water Supply of the Adirondack Region, George W. Rafter.

Insects Affecting Forest Trees, E. P. Felt.

PUBLICATIONS RECEIVED.

University of Wisconsin Agricultural Experiment Station, Bulletin No. 105.

The Improvement of Home Grounds. 39 pp., 32 cuts. Madison, Wisconsin, October, 1903.

Birds of Nature. Vol. XV, No. 1. January, 1904. Illustrated by color photography.

Bulletin of the Department of Agriculture. Kingston, Jamaica, December, 1903.

U. S. Department of Agriculture. Farmers' Bulletin No. 183. Meat on the Farm; Butcher-ing, Curing, and Keeping. Washington D. C.: Government Printing office, 1903.

The Journal of Geography. Vol. III, No. 1. January, 1904. An illustrated monthly magazine devoted to the interests of the teachers of geography in elementary, secondary, and normal schools. Chicago, Illinois.

U. S. Department of Agriculture, Office of Experiment Stations, Bulletin No. 139. Special and Short Courses in Agricultural Colleges. By D. J. Crosby. An excellent source of information as to requirements and scope of courses for young people who intend to enter upon agricultural study.

U. S. Department of Agriculture. Farmers' Bulletin No. 184. Marketing Live Stock. Valuable pointers for all those connected in any way with the cattle industry.

Department of the Interior, Bureau of Agriculture, Bulletin No. 3. Soil Conditions in the Philippines. Manila: Bureau of Public Printing, 1903.

Philippine Bureau of Agriculture. Farmers' Bulletin No. 3. Modern Rice Culture. By Wilfred J. Boudreau. Manila: Bureau of Public Printing, 1903.

Insects Affecting Forest Trees. By E. P. Felt, D. Sc., State Entomologist of New York. Reprint from Seventh Report Forest, Fish, and Game Commission. Albany, N. Y.: J. B. Lyon Co., printers, 1903.

U. S. Department of Agriculture, Bureau of Animal Industry, Bulletin No. 53. Reports on Bovine Tuberculosis and Public Health. By D. E. Salmon, D. V. M., Chief of Bureau. 60 pp. Washington, D. C.: Government Printing Office, 1904.

The Plant World Vol. VII, No. 1. January, 1904. An Illustrated Monthly Journal of Popular Botany. Official Organ of the Wild Flower Preservation Society of America. The Plant World Company, Washington, D. C.

Schweizerische Zeitschrift für Forstwesen. Organ des Schweizerischen Forstvereins. Redigiert von Dr. F. Fankhauser. 54 Jahrgang, No. 12. Bern: Verlag von R. Francke, 1903.

Philippine Bureau of Agriculture. Farmers' Bulletin No. 3. Modern Rice Culture. Manila, P. I., 1903.

Department of the Interior, Bureau of Agriculture, Bulletin No. 3. Soil Conditions in the Philippines. Charts and half-tones. Manila, 1903.

Arboriculture. Vol. II, No. 10. Lumberman's Number. Indianapolis, December, 1903.

Mitteilungen des Deutschen Forstvereins. IV Jahrgang, No. 6. Verlag von Julius Springer. Berlin, Dezember 15, 1903.

Bulletin de la Société Centrale Forestière de Belgique. 12^e livraison, Décembre, 1903. Bruxelles: Imprimerie F. Vanbuggenhoudt.

Arboriculture. Vol. III, No. 1. Indianapolis, Indiana, January, 1904. Manufacturers' number.

The Indian Forester. Vol. XXIX, No. 12. A Monthly Magazine of Forestry, Agriculture, Shikar, and Travel. Allahabad, December, 1903.

U. S. Department of Agriculture, Bulletin No. 33. Weather Bureau. Price, 35 cents.

Weather Folk-Lore and Local Weather Signs. By Edward B. Garriott, Professor of Meteorology. 153 pp. Charts. Washington: Government Printing Office, 1903.

Annual Progress Report of the State Forest Administration in South Australia. 1902-1903. By Walter Gill, F. L. S., F. R. H. S., Conservator of Forests. Adelaide: C. E. Bristow, Government Printer, September, 1903.

NEW MEMBERS OF THE AMERICAN FORESTRY ASSOCIATION.

The following-named persons have joined the American Forestry Association since our last issue:

Aitken, George, Woodstock, Vt.

Baird, John S., Cass Lake, Minn.

Barker, Edwin B., Nacogdoches, Texas.

Bates, Mrs. John D., Center Harbor, N. H.

Bourne, Ralph W., 22 Thayer Hall, Harvard University, Cambridge, Mass.

Bowler, Robert P., Union Club, New York city.

Bowser, Horace F., Stoneham, Mass.

Bristol, Harold R., Meriden, Conn.

Bullock, Rufus A., 27 School st., Boston, Mass.

Carter, Edwin E., 70 Whalley avenue, New Haven, Conn.

Carter, Hon. Geo. R., Box 447, Honolulu, H. T.

Clinch, C. E., Grass Valley, Cal.

Colby, Forrest H., Bingham, Me.

Craig, A. R., Forest Supervisor, Mesa, Colo.

Crawford, C. G., 315 H street N.W., Washington, D. C.

Curtis, Edwin P., care Richardson Mfg. Co., Worcester, Mass.

Daly, Dr. James H., Pierce square, Dorchester, Mass.

Damon, Miss Teresa, 11 Park avenue, New York city.

Dayton, J. H., Painesville, Ohio.

Dean, Mrs. George W., 570 Rock street, Fall River, Mass.

Farley, George, Cass Lake, Minn.
 Gardau, Otto, 41 Dey street, New York city.
 Giffard, Walter M., Box 308, Honolulu, H. T.
 Gill, George W., Columbus, Ohio.
 Hale, Henry S., 1510 North Broad street, Philadelphia, Pa.
 Hyde, Dana C., 141 Hancock street, Cambridge, Mass.
 Kerr, John N., 218 McGill Building, Washington, D. C.
 MacMillan, J. H., 507 Chamber of Commerce Building, Minneapolis, Minn.
 Pevear, T. F., Biltmore, N. C.
 Reilly, C. J., 344 Jefferson ave., Detroit, Mich.
 Seely, J. B., Virginia City, Mont.
 Sisson, F. W., Flagstaff, Ariz.
 Smith, W. Hinckle, 2025 Locust street, Philadelphia, Pa.
 Stetson, Mrs. Francis L., 4 East Seventy-fourth street, New York city.
 Stone, Miss Bessie P., 1109 Sixteenth street, N. W., Washington, D. C.
 Vanderlip, Hon. F. A., 14 East Sixtieth street, New York city.
 Walter, Raymond F., Chamber of Commerce Building, care U. S. G. S., Denver, Colo.
 Weber, Geo. A., 71 Broadway, New York city.
 White, Mrs. Lovell, 1616 Clay street, San Francisco, Cal.
 Whiting, George H., Yankton, S. D.
 Zavitz, E. J., 135 Howe st., New Haven, Conn.

PUBLISHER'S NOTES.

It is a pleasure to commend to our readers the well-known firm of J. M. Thorburn & Co., whose advertisement appears on the rear cover of this magazine. Messrs. Thorburn & Co. have carried on their business of supplying seeds of all kinds for more than 100 years. We have lately received their large illustrated catalogue for 1904, which contains lists and cuts, not only of all kinds of vegetable and flower seeds, but also of agricultural and horticultural implements and garden requisites. Of especial interest are the lists of tree and shrub seeds, both coniferous and deciduous.

Perhaps you have noticed that the older men in the U. S. field parties carry Marble knives. They have learned to look for quality in the few things they are allowed to carry. The younger ones break up a few cheap foreign knives, and then take their elders' advice.

If you take the interest in good rifle shooting which a good citizen, and particularly a

forester, should display, your heart will warm toward Marble's new rifle sights. They look ever so much like the time-tried Lyman, but Marble says they are better, and if that is the case they must be cracker-jacks. You can look right under the bead of the front sight. Catch the idea?

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The Scandinavian Tree Seed Establishment, carried on at Copenhagen, Denmark, since 1887 by Johannes Rafn, is prepared to furnish a large variety of tree seeds suitable for plantations or park and lawn ornamentation. This firm can supply a long list of American conifers in addition to European, West Asiatic, and North African species. They also handle a good line of deciduous trees and shrubs from all quarters of the globe.

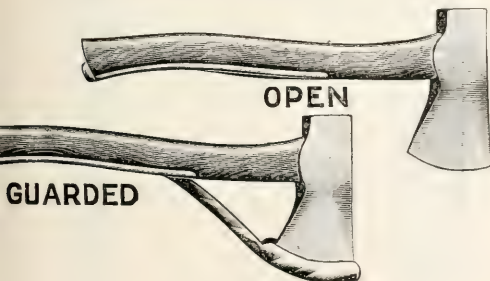
Thomas Meehan & Sons, the old reliable nurserymen and tree seedsmen of Dresher-town, Pa., are offering a large stock of 3-year-old transplanted White Pine seedlings for delivery next April. These plants are 8-12 inches high, and will be found exactly what is needed for a vigorous forest plantation. Price, \$8 per 500, or \$15 per 1,000, F. O. B.

White Pine seed is below the normal crop, but orders will be booked now, subject to the usual conditions as to crop, at \$2.75 per pound; 10 pounds or more at \$2.50. Postage extra, 10 cents per pound.

J. A. Gage, proprietor of the Gage County nurseries of Beatrice, Nebraska, writes that in his experience the old scheme of rubbing blood and liver on the bark of young orchard trees as a protection from rabbits is not a success; neither does he advocate the use of wood veneer. His scheme is to trap the rabbits, and also to wrap tarred building paper loosely around the trunk of the tree. This is also a good preventive for borers.

The spring season for tree planting will be at hand soon—so soon, that unless you make up your mind at once and put in your order for seeds and seedlings, you are liable to be among those who will receive only regrets from the seedsmen.

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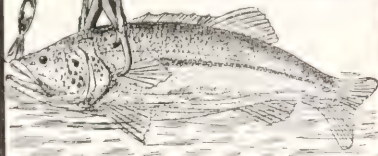
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Any of our subscribers (or borrowers) who come across good material for "Forest Fables" are invited to send it in "on suspicion."

IT is a well-known fact that life in the forest, with its concomitants of hunting and fishing, will develop a romancer of the most unblushing type from one who at home is a staid, unimaginative man of business and a prop to the sanctuary.

After a week in the woods the artificial veneerings of civilized truthfulness warp, split, and fall away from the man like shriveled husks from an ear of corn, leaving his real seamy nature exposed. All men then behold him as his ancestor was in the Stone Age—a cunning, shifty creature, puffed with the vanity of his own achievements in war and the chase, and ever desiring to chant his deeds.

With the most engaging candor he will tell you, as you smoke together over the evening camp-fire, that the buck he killed in the morning was 270 paces away and dashing along in full career when the fatal shot was fired. He will prove it by showing you his rear-sight, still elevated three notches. He will flatter your judgment, tickle your self-esteem, and prostitute the sacred bonds of friendship in order to convince you.

You, meanwhile, are perfectly well aware that the man can not hit a stationary tomato can at thirty feet. But do you flout and contradict him? By no means. Your very heart warms to him, for you feel within your bosom the secret workings of similar impulses, inherited from a thousand shaggy ancestors of luxuriant imaginations.

You listen with a look which expresses only the most childlike credulity and bland appreciation. No hint of suspicion can be detected in your tones; your glance meets his unflinchingly, and, having rendered the homage of respectful attention to his recital, you gather all your resources of wit and craft and launch forth upon a tale which can give his story cards and spades.

Now, in the Stone Age it was considered perfectly good form for the first raconteur to arise at the psychological moment and bash his successful opponent painfully upon the head with a large jagged war-club.

This form of retort has been abandoned of late by those who pride themselves on smartness of demeanor. No. 1 is expected merely to show his teeth in pleasant fashion at No. 2, and perhaps undermine his reputation for veracity upon returning to his clubs in town.

Yes, the forest is certainly a magic realm. Its atmosphere is full of giants and werewolves and marvelous things. Under its influence a man harks back and takes to the telling of tales which are good in all points except that it would be very difficult for them to happen.

TWO GASEOUS FABLES.

Think of Hans Christian Andersen, and Grimm, and Baron Munchausen, and all of

the other fellows who write stuff about the magic bean-stalk growth of Eucalypts and how to pull up stumps by letting a pond freeze around them and yank them out by hydraulic pressure. They all understand very well that probably nobody will call them down if they just make a good bold bluff, because most people will think it might be so as long as it is in the forest. While you are thinking of these gentlemen, it would be a good scheme to think of Ananias also, for to omit him at such a time would seem like invidious discrimination. Speaking of him brings to mind an alleged news item which apparently came from some logging district of Pennsylvania. It runs to the effect that after cutting down a hollow tree in that region the woodmen were surprised by a rush of natural gas which burst forth from the hole in the stump and threatened to destroy the entire surrounding forest upon becoming ignited accidentally. The strangest part of the affair, however, and one which is given no mention in the item, is that this great volume of gas emanated entirely from the man who wrote the thing up.

Pennsylvania is not alone with her gaseous inventors. They have them out in California, too. In that country much interest is felt in the matter of reforestation, for which work large amounts of tree seeds are necessary.

But think of climbing a California tree—say, for instance, a Sugar Pine, with its ten or twelve feet in diameter at the butt and its two hundred and more feet of towering trunk. Sugar Pine seed must be had, though, and in order to fill the interval until Professor Langley can perfect his flying machine an ingenious civil engineer comes forward and modestly announces that he has solved the difficulty.

His plan is to soar aloft in a hydrogen balloon and pluck the cones from a secure position in the car. It's easy, he says. All you have to do is to transport the balloon over the mountains to the place where it is needed, on a mule's back, being sure to take along plenty of zinc and sulphuric acid with which to manufacture the hydrogen. The method of operation is obvious, and as there are not more than seven or eight reasons why the plan wouldn't work, the inventor is clearly deserving of a vote of thanks.

It is unfortunate that the gas-gushing stumps are not more conveniently located. One of those could inflate a balloon in short order. That would save carrying acid on muleback. Only consider how a mule would act if a few drops of acid came in contact with his hide!

We offer it as an amendment that hot-air balloons would be more convenient. Of course the hot-air generator would have to be taken along; but his keep wouldn't amount to much and it might prove right convenient to have a civil engineer in camp once in a while, if he could be kept securely corked when not in actual use.

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GROUP B.—22,000 acres, estimated to cut 80,000,000 feet of choice cypress, 70,000,000 choice short-leaf North Carolina pine, balance of timber oak, ash, hickory, sycamore, gum, etc.

GROUP C.—14,000 acres, estimated to cut 30,000,000 feet of choice cypress, 15,000,000 of oak, 15,000,000 short-leaf pine, 8,000,000 cottonwood, 10,000,000 ash, balance hickory, sycamore, elm, gum, etc.

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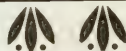
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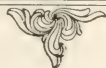
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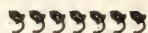
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2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.

3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.

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5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.

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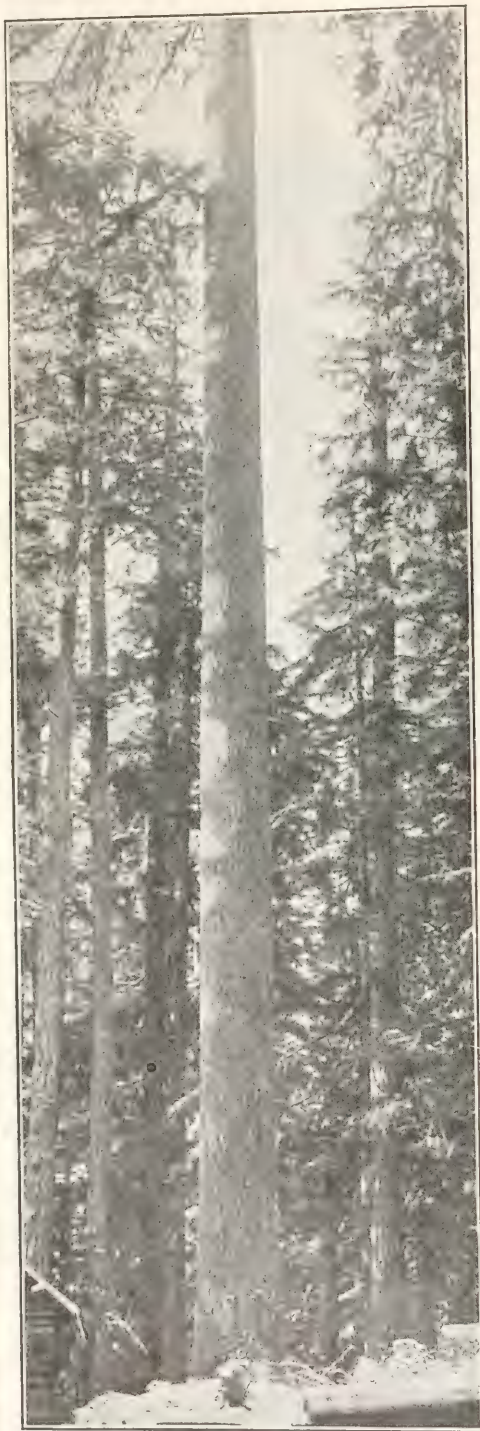
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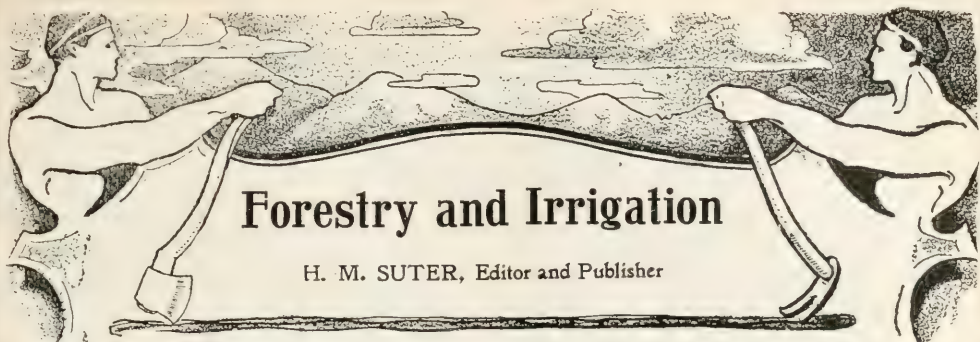
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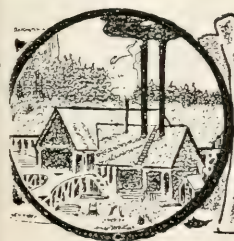
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Forestry and Irrigation.

VOL. X.

MARCH, 1904.

No. 3.

NEWS AND NOTES.

The Crisis at Albany. Last spring more than half a million acres of forest land in northern

New York were ravaged by fires resulting from the unparalleled drought and the carelessness and viciousness of human kind.

The railroads, seemingly in arrogant consciousness of power, broke almost every provision of the law relating to the precautions to be observed by them within forest lands. They were responsible for more than 50 per cent of the acreage burned in the Adirondacks, but so far they have escaped scot-free with the exception of private suits for damage.

The railroads are the greatest danger which threatens the welfare of New York forests. Next in order come the careless use of fire in fallowing, and incendiaryism arising from the growing resentment the natives feel toward the encroachments of great private game preserves to hunting grounds formerly free to all.

New York stands at the parting of the ways. The time has come when she must either adopt an up-to-date, vigorous, rational policy in regard to the forests of the Adirondacks and the Catskills, or else relinquish the worthy position which for years has distinguished her among all the states as the foremost in matters of forest economics.

Her forest laws have never been perfect. Their claim to merit is based largely on comparison with other states, which have either worse laws or none at all. They can no longer endure comparison with those states which are about to enact codes based on the recommendations of experts in forestry.

The existence of the Senate Committee

on Forest Policy (whose report appears in this number) is a hopeful sign. We do not doubt the ability or zeal of its chairman, Senator Brown. The recommendations are good, although almost too conservative considering the value of the property whose safety depends upon them. Nothing less will suffice, and yet we can hardly hope that bills based upon them will ever become law, unmodified and un mutilated, considering the opposition and the pitfalls which surely await them in the Legislature and elsewhere.

If the severe lesson of last year does not arouse the people of the state and their representatives to vigorous and well directed action for the protection of the forests at this time, there is indeed little hope for the Adirondacks. Conditions there will not improve by being let alone. One more catastrophe like that of 1903, and there will be little left worth protecting.

If a good law is secured it is up to the governor to see that it is rigidly enforced. There is too much regard for the feelings of powerful corporations in New York. For the sake of New York's forests we could wish that Mr. Roosevelt were governor still.

If the present opportunity is allowed to pass, a lasting stigma should and will rest upon the Legislature; the old excuse of ignorance is no excuse now. There are plenty of Americans who know very well what needs to be done, and there can be no defense for the enactment of any more such confessions of impotence as the constitutional clause at present in force, which evident fear of timber frauds has so encumbered with preventives that it defeats its own true purpose by preventing the necessary care of the forest lands.

Important Desert-land Decision. A recent important decision affecting entries made under the desert-land act by the Secretary of the Interior is contained in the following letter to the Commissioner of the General Land Office:

*The Commissioner of the
General Land Office.*

SIR: By decision of July 23, 1903 (32 L. D., 207), the department accepted the final proof of John Cunningham under his desert-land entry for the S. E. $\frac{1}{4}$ of the N. E. $\frac{1}{4}$, sec. 21; the S. W. $\frac{1}{4}$ of the N. W. $\frac{1}{4}$ and the N. $\frac{1}{2}$ of the S. W. $\frac{1}{4}$, sec. 22, T. 43 N., R. 108 W., Landor, Wyoming, land district.

It is possible that some expressions in that decision may be taken as indicating a purpose to encourage the offer and sanction the acceptance of final proofs in desert-land entries that do not clearly establish a strict compliance with all the requirements of law. Such a result was not contemplated when that decision was rendered, nor does the department intend that there shall be any relaxation in the enforcement of the requirement that such proofs shall conclusively demonstrate that the law and regulations governing such matters have been complied with in every essential particular.

Possibly the proof in that case was not so clear and explicit as such proofs should be; yet it is not deemed necessary or advisable to recall the decision accepting it for further consideration for the purpose of laying down with greater exactness the proper rule to be observed in passing upon final proofs in desert-land entries.

Proof which shows that because of irrigation there is, on the land, "a marked increase in the growth of grass," or that "grass sufficient to support stock has been produced on all the land," will not be accepted as showing a compliance with that provision of the amendatory act of 1891 (26 Stat., 1095) "that proof be further required of the cultivation of one-eighth of the land." Actual tillage must, as a rule, be shown. If, however, it be shown, and it must be made to conclusively so appear, that,

because of climatic conditions, crops other than grass can not be successfully produced, or that actual tillage of the soil will destroy or injure its productive qualities, the actual production of a crop of hay of merchantable value, as a result of actual irrigation, may be accepted as sufficient compliance with the requirement as to cultivation.

That the entryman has an absolute right to sufficient water to successfully irrigate the land; that the system of ditches to conduct the water to and distribute it over the land is adequate for those purposes, and that the land has been actually irrigated for a sufficient period of time to demonstrate the sufficiency of the water supply and the effectiveness of the system are essential facts which must in all cases be clearly established by the proofs.

You will take such measures as may be proper to bring these matters to the attention of the local land officers.

Very respectfully,

E. A. HITCHCOCK,
Secretary.

This decision will be of great aid to the reclamation service in protecting the lands withdrawn in connection with the various Federal irrigation projects. Desert-land entries made prior to these withdrawals and coming within their areas will have to come up to the prescribed standard or be canceled.



**Death of
Henry
Michelsen.**

Henry Michelsen, supervisor of the Pike's Peak Forest Reserve, died February 19 of pneumonia, at his home, in Denver, Colorado, aged 56 years.

Mr. Michelsen was born in Schleswig-Holstein. He had a remarkable career, and had traveled a great deal in the old world and obtained a general knowledge and education much above the average.

He became a citizen of the United States in 1869, and the same year entered upon his work as a railroad man, which occupation he followed in various positions and localities for more than thirty years.

He helped build the International and Great Western, and was prominently connected with the Galveston, Houston and Henderson road, in Texas.

Later, until 1898, he had charge of the freight business of the Colorado and Southern. In July, 1902, he became supervisor of the Pike's Peak group of reserves. His personal energy and understanding of his work soon made his reserve known as a model of administration.

Mr. Michelsen was a student of forestry, geology, political economy, and kindred topics. He spent much time in preparing articles upon these subjects, which attained considerable circulation in the magazines.

At the time of his death he was vice-president of the American Forestry Association for Colorado, and of the Colorado Forestry Association as well. He was also a member of the National Irrigation Association, the American Association for the Advancement of Science, and of the National Geographic Society.

The Sportsmen's Show. The tenth annual exhibition of the Sportsmen's Exposition Company, which was held at Madison Square Garden, seemed to take the public fancy quite as strongly as did its predecessors.

Exhibits crowded the entire available space, and the center was occupied by a great tank, upon which canoe races, tilting, and birling were carried on. This artificial lake also allowed of the display of launches and automobile boats.

The east end of the garden was made to represent a mountain scene, through which dashed a real stream, which turned the wheel of an old mill and passed on to supply one of the tanks.

Guides from all the famous sporting regions maintained model camps, as has been the custom at previous shows, and much greenery was in evidence.

A feature was the fly-casting contests, which took place every day under the rules of a special committee. The show began February 19 and lasted until the fifth of the present month.

Development of Red Gum. Red gum (*Liquidambar styraciflua*) is rapidly gaining in favor with

the lumber trade. Nearly every issue of the lumbermen's journals pay increased attention to the interests of those who manufacture it and the increased capital and brains devoted to its introduction and to the overcoming of certain prejudices against it. "Doubtless," says an exchange, "the scarcity of other staple and higher-priced materials has had something to do with the interest that has lately been manifested in gum. A few manufacturers, firmly convinced of success, have for several years past encountered the usual difficulties to be met in introducing any new thing, until by degrees the objectionable features have practically been overcome. Efforts of individual concerns have been combined and a systematic educational campaign has been started. First of all, uniform grades were necessarily established, and to facilitate this work the Dressed Gum Lumber Manufacturers' Association was organized by a small body of determined men, honest in their conviction that gum, properly treated and carefully selected, is unquestionably the best suited medium-priced wood for building material obtainable, not even excepting yellow pine. Tests, indoors and out, have demonstrated the truth of these statements, and the increasing number of satisfied users is fast adding preponderance to these arguments."

Among the main objections which have kept gum in the background heretofore are its tendencies to warp and to discolor in drying, making necessary certain preventive treatment which is not employed with other woods. To prevent discoloring, girdling is practiced by some operators. Others claim to secure the same brightness of lumber by felling only in the winter.

On account of the growing interest in gum and the valuable substitute which it offers for other hardwoods now becoming scarce, the Bureau of Forestry has lately begun to investigate the stand and properties of this wood and the present marketing conditions. It is hoped that the investigations will result in the collection of information valuable

to both the trade and consumers as soon as the field notes can be properly worked up. The work is in charge of Mr. Alfred K. Chittenden, who is at present in the field with a party on the Santee River in South Carolina. A second party is at work in Missouri.

Canadian Pacific's Enterprise. It is announced that the Canadian Pacific Railway is preparing to reclaim a large tract of land located a little east of Calgary, in Alberta. The tract is 150 miles long by 60 miles wide and contains 5,700,000 acres.

The preliminary surveys are complete and it is estimated that about 1,500,000 acres can be put under irrigation at a cost approximating \$3.00 per acre.

Meetings of Foresters. An open meeting of the Society of American Foresters was held at the residence of Mr. Gifford Pinchot, Thursday, February 11.

The first speaker was Mr. John S. Foley, who, in the absence of Mr. Raphael Zon, presented for the latter gentleman an interesting study of chestnut carried on over parts of Anne Arundel, Calvert, Charles, and Prince George counties, in Maryland. The discussion was illustrated by novel diagrams based on the curves secured from the surveys, and included comparative data secured from seedling and coppice growth.

Mr. Charles A. Scott, in charge of the planting reserve at Halsey, Nebraska, outlined the work which has been done in establishing the forest nursery at that point, with a general statement of the methods employed in raising the seedlings, results secured in planting in the Sand Hills, and the expense per 1,000 seedlings of the various operations. The original nursery has received two additions, one of which employs a new style of movable sun-screens.

The following Thursday the meeting took place in room 135, in the offices of the Bureau of Forestry.

Mr. Potter named the ten principal objections which are offered to the establishment of forest reserves, and showed

the mistaken conceptions which are so largely responsible for this opposition.

Mr. H. J. Tompkins talked of the California forests from the point of view of a fire study. He believes that the incessant surface fires are out of all proportion to the needs of the situation, and are the result of the most general carelessness and indifference. The troublesome and useless chaparral is largely due to the action of repeated fires. The most obvious remedy is first to decrease the number of fires, in order to accomplish which the people must be made to realize the harm done by even light burns.

Mr. Hodge gave a general outline of the plan for protection of California forests, the field work for which was partly done last summer under his superintendence.

Mr. Sudworth read resolutions on the death of Mr. W. C. Whitney, an associate member of the Society, which were adopted by the members present. It was ordered that a copy be sent to the bereaved family, and that the resolutions be spread upon the records of the Society.

Extraordinary Timbers. The eight corner poles that are to support the Washington State building at the World's Fair at St. Louis have arrived. Seven of the poles are 100 feet long; the eighth is 110 feet long. Each is squared to 24 inches for its full length.

With the poles came a round pole, 100 feet long, which will be used as the flag-staff for the Hoo-Hoo House. The poles are of Douglas fir, weigh 21,120 pounds, and contain 5,200 feet of timber. They were shipped on four flat cars from Skagit county, near Tacoma, and the freight bill was \$1,100.

The eight squared timbers are said to be the most valuable pieces of timber, aside from rare woods, ever cut. Their great value lies in their length. It is not unusual to find a tree that will yield a round and tapering pole of 100 feet long, but it is very unusual to find one which will permit of being squared to 24 inches for 100 feet of its length.

The World's Fair.

It seems that the space allotted to forestry in the Palace of Forestry, Fish, and Game is not likely to prove sufficient for all the exhibits entered. On this account a part of the exhibits will be installed in the building of the House of Hoo-Hoo.

In addition to the exhibits of the states and the United States previously mentioned in these columns, the manufacturers of forest products, such as wooden ware, cooperage, basketry, wood-pulp, wood-alcohol, turpentine, and resin, need a great deal of room.

The outdoor display of forest management, forest extension, and such forest products as are too large for accommodation in the building already requires 15 acres of space.



As Others See Us.

We have become so accustomed in the past few years to hear only depreciatory and apologetic mention of our progress in the art of forestry, that it is distinctly refreshing to encounter a more hopeful view of American ability and accomplishment along this line.

Such comment is the more grateful in that it comes from an old-world critic.

A recent issue of the *Indian Forester* speaks as follows of the work of the Bureau of Forestry in the Philippines:

"We note that our American cousins have imported some of their characteristic dash and up-to-dated-ness into their newly acquired possessions, and the forest department of the islands appears to have already commenced work on the best possible lines. The American Bureau of Forestry has inspected the forests and prescribed rough plans of working under which a royalty is charged on all trees felled, and only those trees which have previously been selected and marked by the department can be felled and logged by the lumbermen. The forests are thus preserved from that reckless and extravagant cutting which so often follows the taking over and opening out of a country by a highly civilized power. There can be little doubt of the value of the American Bureau of Forestry. India still sits and waits for hers!"

Would it not be as well for us to give up the Uriah Heep attitude for a while? It is liable to become chronic otherwise, though we know well that Europeans would select any other trait than meekness for our national characteristic.

We need not close our eyes to our



A MOUNTAIN RESERVOIR FED FROM ETERNAL SNOWS.

present imperfections, nor lose sight of the fact that there is a big job ahead, but we should at least recognize the fact that a great work has already been done in giving its present irresistible force to the movement which will finally place American forests on a safe and rational basis of management.

February Forest Fire.

Dispatches from Albuquerque and Las Vegas, New Mexico, say that a fierce forest fire broke out on the Las Vegas grant, about 18 miles from Las Vegas and close to the Pecos Reserve, early on the morning of February 13.

The rangers and all available aid immediately began to fight the flames, which were driven by a strong wind. The country was very dry and the fire fighters were unable to make any effective resistance to the fire, which burnt out on the morning of the fifteenth.

The loss includes many thousands of dollars' worth of pine timber and lumber and two ranch houses, with all their adjacent buildings. The village of Las Dispensas was saved by a shift of wind. It is believed that considerable stock perished.

Errata.

The kindly interest of our readers is evinced by two letters from the West drawing attention to an error and an omission in recent notes of forest fires in California. It is a matter of regret that the only source of information on these matters (the leading newspapers of the region) has proved so unreliable. Any such corrections are always welcome.

From a trustworthy source we have had a letter stating that accounts of the Fredalba fire in January were grossly exaggerated. It says: "The area burned over was 3,500 acres instead of 40,000, as formerly reported, of which 1,500 acres were in the San Bernardino Reserve. Practically no standing timber was destroyed, the burn being confined to cut-over land and chaparral. The Brookings Lumber Company lost 2,000,000 feet of sawed timber instead of 5,000,000. The cause was undoubtedly the carelessness of the men in charge of donkey engines on the Brookings works,

and the company advanced the theory of incendiarism to cover the guilt of their own men.

"The Brookings Lumber Company is a curse to the reserve, and they should be made responsible for the damage the fire caused. Their carelessness and indifference is notorious, and their lumbering is a systematic process of devastation."

Another letter from California states that we have made no mention of extensive fires in Shasta county during August, September, and October, 1903, which involve more than 30,000 acres of land owned by the United States, T. B. Walker, Buick and Wengler, and the Mountain Copper Company. The cause of these fires is said to be incendiarism on the part of local cattlemen, who wished to drive out encroaching bands of sheep and goats.

Forest Reserve Personals.

Ranger G. B. Coleman has been placed in charge of the western division of the Washington Forest Reserve. Ranger Geo. W. Milham is in charge of the eastern division of the same reserve.

Ranger Louis F. Mosimann has been transferred from the Gila River Forest Reserve to the Pecos River Forest Reserve, in New Mexico. Ranger Ernest E. Wright has been transferred from the Lincoln Reserve to the Gila River Reserve.

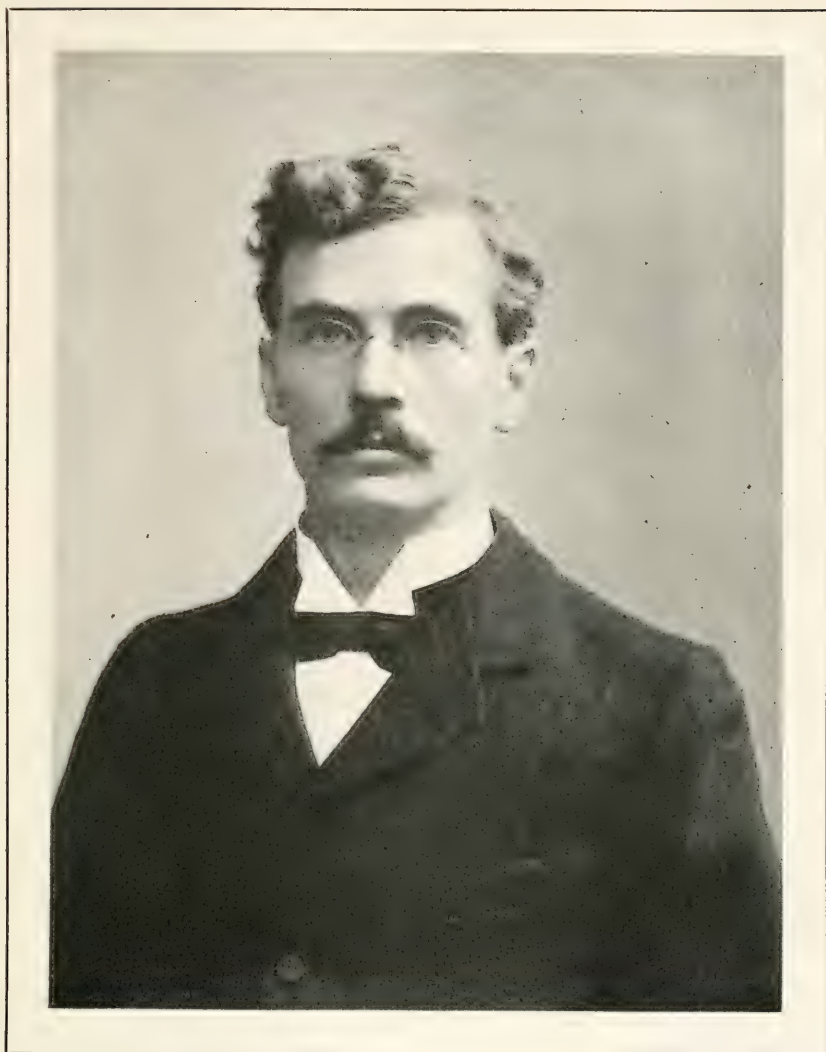
Forest Inspector R. H. Charlton is initiating administration of the Aquarius Reserve, in Utah, and the Pocatello Reserve, in Idaho.

Forest Inspector Louis A. Barrett has left Washington for examination of reserves in the Southwest.

Ranger W. D. Edmandston has been placed in charge of the Pike's Peak group of reserves.

Supervisor E. F. Morressey, of the Wichita Reserve, has recently been granted an advance in salary.

Harry T. Britten, formerly employed as a ranger in the Yosemite National Park and who was accidentally shot and incapacitated for active duty in patrol, has been assigned to employment in the office of Forest Superintendent C. S. Newhall.



ARTHUR POWELL DAVIS,

SUPERVISING ENGINEER OF THE U. S. RECLAMATION SERVICE.

A RTHUR POWELL DAVIS was born at Decatur, Ill., February 9, 1861, the son of John and Martha P. Davis. He was educated at the Junction City (Kans.) High School, afterward graduated at the State Normal School, Emporia, Kans., and still later studied engineering subjects at Columbian University, Washington, D. C. From 1884 to 1894 he was a topographer in the Geological Survey, conducting surveys and explorations in Arizona, New Mexico, and California. From 1895 to 1897 he was a hydrographer in charge of government stream measurements, and has been in charge of the hydrographic examination of the Nicaragua and Panama Canal routes since 1898.

While Mr. Davis has been closely identified with the reclamation work as a whole, his efforts in connection with the Tonto Basin project in the Salt River Valley, Arizona, have attracted wide attention, as it is an extremely interesting piece of work, both from an engineering and economic standpoint. His present high position has been attained at an early age, which assures the country his services for many years to come.

Both by training and inclination Mr. Davis is well fitted for a leading part in the great work of government reclamation of arid lands, which is now well under way. He is of that type of men which have built up the U. S. Geological Survey into what has come to be very generally considered the most effective bureau in the government. For the last twenty years, during which the Survey has made its greatest advances, Mr. Davis has been in its service continuously.

REPORT OF PUBLIC LANDS COMMISSION.

A PRELIMINARY STATEMENT, WHICH CONTAINS RECOMMENDATIONS FOR CHANGES IN THE EXISTING LAND LAWS—TRANSMITTED TO CONGRESS WITH THE PRESIDENT'S LETTER OF APPROVAL, MARCH 7, 1904.

*To His Excellency Theodore Roosevelt,
President of the United States.*

SIR: This Commission, appointed October 22, 1903, to report to you upon the condition, operation, and effect of the present land laws, and to recommend such changes as are needed to effect the largest practicable disposition of the public lands to actual settlers who will build permanent homes upon them, and to secure in permanence the fullest and most effective use of the resources of the public lands, respectfully submits the following partial report:

MEETINGS OF COMMISSION.

During the month of December, 1903, the Commission sat in the office of the Commissioner of the General Land Office to receive recommendations and hear the arguments of all who might appear before it. Notice of these sittings was published through the press and special invitations to be present were extended to the Public Lands Committees of the Congress. Senators and Representatives and others appeared before the Commission.

In January, 1904, Messrs. Pinchot and Newell, of the Commission, attended the meetings of the National Livestock Association and of the National Woolgrowers' Association in Portland, Oreg., and participated in the sessions of those associations. Returning, they also visited Sacramento, Cal.; Reno, Nev.; Salt Lake City, Utah; Denver, Colo.; Cheyenne, Wyo., and conferred with governors, state land boards, public officials, and citizens generally, and discussed the questions under consideration by the Commission. Upon the return of Messrs. Pinchot and Newell to Washington the meetings of the Commission were resumed.

ANTIQUATED LAND LAWS.

The information obtained by the Commission through the conferences in

the West and the hearings in Washington discloses a prevailing opinion that the present land laws do not fit the conditions of the remaining public lands. Most of these laws and the departmental practices which have grown up under them were framed to suit the lands of the humid region. The public lands which now remain are chiefly arid in character. Hence these laws and practices are no longer well suited for the most economical and effective disposal of lands to actual settlers.

TIMBER AND STONE ACT.

Under the act of June 3, 1878, generally known as the Timber and Stone Act, there has lately been an unusual increase in the number of entries, which can not be accounted for by an increase in the demands of commerce or by any unusual settlement of the localities in which the greater part of the entries were made. In 1902 there were 4,022 entries under this act, aggregating 545,253 acres, while in 1903 there were 12,249 such entries, aggregating 1,765,222 acres. A very large proportion of these entries were upon timbered land. The law was enacted to meet the demands of settlers, miners, and others for timber and stone for building, mining, and other purposes. There is much evidence, however, going to show that many entries have been made for purposes not contemplated by the Congress.

Under this law no residence upon nor cultivation of the tract entered is required. An application is made at the local land office in the district in which the land is situated to purchase 160 acres, or less, of land which it is alleged is chiefly valuable for the timber or stone, as the case may be, which it contains. Advertisement is made for sixty days, naming a date upon which evidence will be offered before the local land officers to prove the character of the land. Upon

the day named such proof is offered, and, if deemed sufficient and there being no protest nor allegation of fraud or collusion, payment at the rate of \$2.50 per acre is made and final receipt is issued. This practically concludes the transaction, the issuing of the patent following in due course of time.

The only grounds upon which the entry by a qualified entryman would be refused are either that the land is not chiefly valuable for timber or stone, or that entry is not being made for the sole use and benefit of the entryman, but for speculative purposes. As the entries under this act are generally made for the timber which the land contains, proof is seldom lacking that the land is chiefly valuable for timber. It is very difficult to prove collusion or that the entry was made for speculative purposes, although it is apparent that many such entries have been made.

In the case of *United States v. Budd* (144 U. S., 154), in a decision made in March, 1892, the United States Supreme Court said (syllabus quoted):

(1) That all the act of June 3, 1878, denounces is a prior agreement by which the patentee acts for another in the purchase.

(2) That M. might rightfully go or send into that vicinity (the vicinity of the land) and make known generally to individuals a willingness to buy timber land at a price in excess of that which it would cost to obtain it from the government, and that a person knowing of that offer might rightfully go to the land office and purchase a timber lot from the government and transfer it to M. for the stated excess without violating the act of June 3, 1878.

The Commission believes that Congress did not intend that this law should be used for the acquisition of large tracts of valuable timber land by individuals or corporations, but it has been used for such purposes. Carefulness and vigilance in its administration can not prevent its being so used. A great number of such entries were recently suspended, but the most rigid investigation failed to show that any considerable proportion of them had been made in violation of the law, and the suspensions were removed. The

fact remains, however, that many of these entries were made by non-residents of the state in which the land is situated, who could not use the land nor the timber upon it themselves, and it is apparent that they were made for speculative purposes and will eventually follow the course taken by many previous similar entries and become part of some large timber holding.

While this law is adapted to and chiefly used for the acquisition of timber land, many entries have been made under it where it was alleged that the land is chiefly valuable for stone. There is no doubt that the land in a very large proportion of such entries was not desired on account of the stone which it contained, but for the purpose of obtaining control of water or to add to other holdings. There are, moreover, other laws under which land containing stone may be entered.

Our conclusion is that the law is defective, because even when properly administered it may be used for purposes for which it was never intended, and we recommend its repeal.

If the timber and stone act is repealed some legislative enactment will be necessary providing for acquiring timber upon the public lands. The manner in which timber upon Indian lands has recently been disposed of suggests a plan for the disposition of this timber upon the public lands. The timber is advertised and sold to the highest bidder, with the result that the market price has been obtained.

Some means should be provided by which the matured timber upon the unreserved public lands may be sold, not only for the use of individuals, but also to supply the demands of commerce. There is now a provision of law for the free use of timber in limited quantities for domestic and mining purposes which meets the requirements of those needing small quantities, but there is no provision for the sale of timber except from forest reserves.

RECOMMENDATION OF SALE OF TIMBER.

We recommend the enactment of a law under which it shall be lawful for the Secretary of the Interior to sell to the highest bidder, at public outcry or oth-

erwise, under such rules and regulations and subject to such conditions and restrictions and in such quantities as he may prescribe, the right to cut and remove, within such period of time as he may fix, any timber from any unappropriated, nonmineral, surveyed public lands, after first having had such timber duly appraised, and after giving public notice of the time, terms, manner, and place of such sale; that he shall have power and authority to reject any and all bids offered at any such sale, and that it shall be unlawful for any purchaser at such sale to sell, transfer, assign, or in any manner alienate the rights secured by him under this act, except as authorized by said Secretary; that the act entitled "An act for the sale of timber lands in the States of California, Oregon, Nevada, and Washington Territory," approved June 3, 1878, and all acts amendatory thereof be repealed, and that no lands valuable chiefly for timber shall hereafter be patented under the commutation provisions of the homestead laws; that any person who violates any of these provisions, or any regulation or requirement prescribed pursuant thereto, shall forfeit to the United States all benefits conferred and all moneys paid by him, and that any right to cut and remove timber which he may then hold shall be canceled and revoked.

COMMUTATION CLAUSE OF THE HOMESTEAD ACT.

Much evidence has been submitted tending to show that in the prairie states, where it has been most used, the commutation clause of the Homestead Act has been of advantage to the settler without causing serious loss to the government. On the contrary, the government has been pecuniarily benefited by it, because under this act the land is paid for in cash after fourteen months' residence, while without commutation the entryman would receive a patent after five years' residence without paying for the land. It is no doubt true that the great majority of commutations are made in order to get a title to the land, upon which money could be borrowed for its improvement.

There have been abuses of this law as of other land laws, but principally in connection with entries made upon timber lands. It has furnished a convenient means by which an individual could obtain title to 160 acres of valuable timber land which could be readily sold for more than it had cost. In this way large holdings have been acquired.

The timbered areas of the public lands of to-day are generally in mountainous regions, and are not susceptible of a high state of cultivation after being cleared of timber. Entries of such land are seldom made for farming purposes, but if it is desired to do so the settler is permitted, under the law and regulations, to sell any surplus timber upon his claim, the proceeds of which can be used in its improvement. This is a source of revenue available immediately after entry and one which is not enjoyed by the settler upon prairie land.

Our investigations respecting the operations of the commutation clause are still in progress, and we are not prepared at this time to recommend its repeal. We are, however, satisfied that no serious hardship will be imposed upon the actual settler by prohibiting the patenting, under its provisions, of lands chiefly valuable for timber.

DESERT-LAND LAW.

The Commission is of the opinion that the Desert-Land Law should, for the present at least, be allowed to stand, with a few changes in detail. With the experience of the past for guidance, it is possible to enforce this law so that its essential provisions shall be complied with. When this is done it is evident that the entryman will have earned a patent at an expense too great for speculative purposes.

The number of entries is not so large as to preclude actual inspection of each by an agent of the government before final proof is accepted, and the required expenditures for reclamation are of such a character as to be easily ascertained. Especial attention should be directed to the proof that an adequate and permanent water supply has been provided.

There is one defect in this act which should be remedied at once. The act of

March 3, 1891 (26 Stat., 1095), permits the assignment of entries, and to invalidate an entry the illegal intent must assume some tangible form prior to entry. The mere fact that a contract to sell is made after the entry, or any other arrangement whereby the lands are held for some other person, does not warrant cancellation. This feature of the law is the chief objection that might be urged against it.

The right to assign an entry is not in harmony with the fundamental principle underlying the public-land laws that entries should be made for the exclusive benefit of the entryman and not for the benefit of any other person, and its existence practically abrogates the restriction of the act limiting one person to one entry in a compact form, the only actual limitation being to 320 acres, which might embrace a number of noncontiguous tracts taken by assignment.

The interest of the government and of the actual settler will be protected and promoted by a repeal of so much of the act of March 3, 1891, as permits the assignment of desert-land entries.

AGRICULTURAL LAND IN FOREST RESERVES.

However carefully the boundaries of forest reserves may be selected, it is practically inevitable that more or less agricultural land should be included. Such land usually lies in the narrow valleys of the rivers. Its occupation for agricultural purposes is in the interest of the region in which it lies and of the settlers who would make homes upon it. The presence of the latter in the reserves would, under wise laws, operate distinctly for the protection and general advantage of the reserves. It is essential to the prosperity of the public-land states both that the forest reserves should be maintained and that all of the land within their borders should be put to its best use. To exclude all agricultural lands by Presidential proclamation is not feasible, because of their small area, scattered location, and irregular boundaries. Therefore we recommend that such lands be opened to agricultural entry in the following way:

That the Secretary having supervis-

ion of forest reserves may, upon application, or otherwise, ascertain, list, and describe, by metes and bounds or otherwise, lands within such reserves which are chiefly valuable for agriculture, and that the lands so listed may, at the expiration of ninety days from the filing of such lists in the land office of the land district in which they are situated, be disposed of to actual settlers under the homestead laws only, in tracts not exceeding 160 acres in area and not exceeding $1\frac{1}{2}$ miles in length; that when such lands are ascertained and listed upon the application of any person qualified to make homestead entry, such applicant may settle upon and enter such lands thirty days after the date of such filing; that no person settling upon, entering, or occupying such lands shall thereby have a right to use any other lands within such reserve for grazing or other purposes; that any entryman desiring to obtain patent to any lands, described by metes and bounds, entered by him under the provisions of this act, may do so by filing, with the required proof of residence and cultivation, a plat and field notes of the lands entered, made by or under the direction of the United States surveyor general, showing accurately the boundaries of such lands, which shall be distinctly marked by monuments on the ground, and shall post a copy of such plat, together with a notice of the time and place of offering proof, in a conspicuous place on the land embraced in such plat during the period prescribed for the publication of his notice of intention to offer proof, and that a copy of such plat and field notes shall also be kept posted in the office of the register of the land office for the land district in which such lands are situated for a like period; and, further, that any agricultural lands within forest reserves may, at the discretion of the Secretary, be surveyed by metes and bounds, but that no lands entered under these provisions shall be patented under the commutation provisions of the Homestead Laws or be exchanged for other public lands.

To open the reserves to homestead entry without restriction would be in effect to abolish them. We therefore

recommend that the agricultural character of the lands should be officially ascertained, as has been the habit hitherto in the case of agricultural and mineral lands.

The effect of the foregoing provisions is to give an intending settler the right to apply for the particular agricultural land he wants and sixty days' preference in entering it. Through survey by metes and bounds the settler is enabled to take the full amount of 160 acres of actual agricultural land. The principal danger in the administration of this plan is likely to arise from the desire of others than actual settlers to get possession of valuable timber lands on the plea that they are agricultural in character, to cut the timber from the lands, and then abandon them, to the serious injury of the interests which the reserves are created to serve.

Such an abuse would be greatly facilitated by the commutation clause of the Homestead Act, whereas actual settlers on agricultural lands in forest reserves would seldom or never suffer hardship from the requirement of five years' residence. Agricultural lands in forest reserves are not wholly on the same plane as such lands outside, because their use must be subservient to the purposes for which the reserves were created. Their actual occupation by permanent settlers is of the first importance to this object, and shifting of ownership during the first years of settlement and development would be of serious injury to the reserves. We are of the opinion that to allow the application of the commutation clause of the Homestead Act to lands in the forest reserves would tend to defeat the object of the opening of these lands to agricultural entry and would embarrass the administration of the reserves.

LANDS RELEASED FROM TEMPORARY WITHDRAWAL.

In making forest reserves it is usually necessary to withdraw temporarily, pending segregation, considerable areas of land which are known to contain forest growth. These temporary withdrawals are made usually of areas larger than will ultimately be proclaimed as

forest reserves, in order to enable the officers of the government to ascertain what are the existing conditions and to draw the boundaries with care and without interference growing out of speculative entries or selections made not for settlement, but to secure certain advantages which may grow out of the creation of the forest reserve. For this reason temporary withdrawals are essential for the careful delimiting of the forest reserve. When the limits of a forest reserve are determined upon, the excluded lands are restored to entry and settlement.

Experience has shown that speculative entries or large filings of so-called scrip are frequently made upon such excluded land, to the detriment of actual settlers. Therefore provisions should be made to give actual settlers ample time in which to exercise their rights. Accordingly, the Commission recommends that in the event of the modification or revocation of any order temporarily withdrawing lands from settlement and entry resulting in the release of such lands from such withdrawal, or in the event of the exclusion or release of lands from any forest reserve established by the President, under section 24 of the act approved March 3, 1891, entitled "An act to repeal timber-culture laws, and for other purposes," the non-mineral public lands so released from a forest reserve, and not otherwise appropriated or reserved, shall become subject to settlement from the date of the order or proclamation so releasing or excluding them, but shall not become subject to entry, filing, or selection under any law providing for the disposal of non-mineral public lands until after sixty days' notice by such publication as the Secretary of the Interior may prescribe, nor shall they become subject to entry, filing, or selection under any law except the homestead laws until ninety days after said notice.

The Commission will continue its investigations and make further report.

Respectfully submitted.

W. A. RICHARDS.
F. H. NEWELL.
GIFFORD PINCHOT.

THE DRIVE.

HOW LUMBERMEN EMPLOY THE POWER OF
THE SPRING FRESHET, DAMS, AND DYNAMITE,
IN FLOATING THE FOREST CROP TO THE MILL.

BY

ROBERT V. R. REYNOLDS.

ALL through the winter months the sturdy northern lumberjacks have been at work hauling the logs from the cuttings, and unloading them down upon the frozen streams and lakes, and along their banks.

At the "banking" places on the streams the sleds have left thousands of tons of logs, which have been piled in long rollways across the ice and upon the banks as far as they could be conveniently handled by rolling them one over another. On the banks themselves for a long distance is a succession of skids side by side, sloping toward the water and piled high with logs. Barring accidents, the entire cut of the early

winter has been transported to the waterways before the relaxing grip of winter allows any serious damage to the winter roads.

A few days of inaction may intervene between the last of the hauling and the beginning of the drive. The horses are sent out to the settled country before the swamps become impassable, pike-poles and peavies are repaired, and the lower camps are redolent of tallow as last year's driving shoes are searched out of winter storage, fitted with their complement of spikes, and softened with melted grease. Overalls are "staggered," or cut off just below the knee, and long woolen stockings worn.



LOGS ON THE ICE, JUST BEFORE THE SPRING FRESHET.

Through the courtesy of the Bureau of Forestry, U. S. Department of Agriculture, we are enabled to present the accompanying illustrations.—EDITOR.

Some of the men go thus all the year round, but it is particularly the dress of the driver, whose life depends on agility. The boats, which were poled upstream or hauled in during the fall, are overhauled, calked, and soaked tight. They are long, flat-bottomed, double-ended bateaus, with plenty of sheer and sides that tumble home sharply, something like a dory. Enough of them are supplied to carry the whole crew when necessary. Also there has been built a craft called the "wanigan" (Indian *wangan* = bait), larger, and constructed

ning of April the first warm spring days come, and the snow disappears rapidly. For twenty-four hours a warm heavy rain falls. The brooks overflow their banks and the river is no longer able to carry off the increasing volume of water, and rises rapidly. The weakened ice gives way under the tremendous strains imposed upon it. The heavy piles of logs crush through and spread, and the great mass slowly plows its way downstream through the rotten ice, driven by the resistless thrust of the swelling flood behind.



DRIVERS AND BATEAU (ADIRONDACKS).

solidly enough to endure rough work among logs and ice; a floating kitchen and storehouse on the plan of a narrow houseboat.

Every day the sun mounts a little higher in the heavens. Its warm rays penetrate the forest canopy and daily operate with greater power on the snow-clad hillsides. At the beginning of February the snow lay possibly three to seven feet deep, according to the severity of the winter. Now all this great mass of stored water is being released, and taking its way down every little runlet to the rivers on its way to the ocean. During the end of March or the begin-

As soon as possible the logs are picked apart and strung out, in order to avoid a jam at some point below. Everything must be done without delay now, for the flood rises and falls rapidly on the large streams, and advantage must be taken of the upper stage to get the drive safely past the troublesome places. All the huge rollways of logs on the banks of the river are successively launched into the stream as soon as those which were on the ice have moved out of the way. The piles may be 30 feet or more in height and very steep on the side toward the river. The men work in most dangerous positions at the foot of the poised

logs, wrenching and prying at those which hold back the rest.

Suddenly they give way, and the larger part of the towering mass avalanches with a roar into the water. Every log is launched and sent spinning downstream. Some of the men go with the main body of the logs, riding them as surely and fearlessly as circus performers tread the backs of running horses. Their "cork boots" prevent them from slipping, and their pike poles are used in maintaining their balance. They run about on the rolling, swinging logs with

on, while in the ordinary course of affairs they would tie one forefoot up to the saddle-horn and conquer the beast on a soft spot in a corral. Professional pride is a strong point with these gentlemen of strenuous lives.

A part of the crew follows behind, gathering in the stragglers. The freshet is liable to rise over the river banks, in which case many logs float into thickets on low ground or are detained in side ravines or in eddies. All of these must be returned to the stream, and this work entails a great deal of heavy lifting, and



LOGS RUNNING FREELY IN FLOODED STREAM (ADIRONDACKS).

the activity of cats, pushing here, pulling there, always keeping the mass of timbers from becoming too compact or turning across the current, so as to be liable to catch on a snag or rock. The heart of one who sees them thus for the first time is constantly in his throat with apprehension, for every minute they appear to be in imminent danger of death by drowning or crushing.

It may be that they are not averse to a little display of their skill and hardihood at the times when anxious spectators are observed upon the banks. Westerners say that their bronco-busters will let a bad horse do his worst on hard ground if a woman chances to be looking

not infrequent wading hip-deep for hours in the icy water. When a man becomes numbed he takes a run on shore or stands on a log while his fellows beat circulation into his limbs. Occasionally one slips or stumbles and takes an involuntary bath among the logs and floating ice. This is the signal for a roar of laughter and much merciless chaff from the more fortunate. The rest of the day he must work in sodden clothing. A cold, wet shirt discourages loafing, to say the least.

Under such conditions the average man would expect nothing less than pneumonia, but the rivermen are seldom troubled with sickness of any kind.

In fact, the case is quoted of one man who could not sleep at home in his bed on account of asthma, but who suffered no inconvenience when working all day in the water and sleeping under thin blankets on the river shore. Upon returning to his home after the drive he immediately caught a violent cold. However, it can not be claimed that this work is really beneficial to the system in the long run. Many old river drivers suffer greatly from rheumatism as an after effect of exposure in youthful days.

The boats and the wanigan go along with the drive. The commissary, like that of an army, is the most vital point of the drive, and the cook and his helpers are kept very busy indeed. The cook is the best-paid man in the company, excepting only the foreman, and by virtue of his prerogatives is somewhat of a despot. Certainly the cook's disposition and ability have much to do with the success of any such campaign.

During the drive four meals a day are none too much for the ravenous drivers, who eat heartily at 5 a. m., again at 10, then at 2 p. m., and finally at 8 in the evening.

After the two o'clock meal the wanigan casts loose and navigates downstream as far as it is thought the men can bring the drive that night. The evening meal is ready on time, and the wanigan lies moored to the bank, with a lantern hung out to show the hungry men which way to go if their keen noses can not tell them. Do you know just how good coffee can smell under such circumstances?

They sleep ashore on beds of balsam boughs, around great camp-fires, with their wet clothing steaming where it hangs at a safe distance from the heat. Wet boots are kept carefully away from the fire, for the least overheating ruins a wet greased boot with marvelous quickness. The leather fries into a shriveled, brittle substance, which flies into fragments at the first attempt to force a foot inside it.

Where the streams are large, or in lake work, things are done a little differently, and a floating bunk-house is usually provided, which is much prefer-

able to a couch among the rocks in the rain.

Wherever they sleep, they never know at what hour of the night they may be roused and sent out on the stream on account of a sudden change in the volume of water running and the consequent probability of a bad jam or other trouble. Hours before daylight they are afoot and on their way back to the rear. They may be able to run it down as far as the wanigan by breakfast time, and an hour saved may mean all the difference between success and failure when a falling stream must be contended with.

Where the logs are hauled onto a lake they are piled as compactly as possible, and a great boom of logs, chained end to end, is built around them. When the ice goes out the boom is there to prevent them from scattering and make their handling less difficult. In the old days a boom full of logs would be warped along through a chain of lakes by carrying an anchor far ahead and then hauling the boom to the anchor by means of a capstan mounted on a raft. Sometimes a sail was employed when the wind favored. A more usual means nowadays is to build a boom more than long enough to reach across the lake at its widest part. Beginning at the upper end of the lake, one end of the boom is fastened to a point on the shore and the other end is dragged ahead along the opposite shore by a small steam tug as far as it will reach and fastened in turn. The opposite end is then advanced similarly, and in this manner all the logs are swept through the lake.

The logs of several companies may become mingled, as on account of a jam or hard luck one drive may overtake another. This makes no difference, unless the crews take a dislike to each other and make mischief. Otherwise they will work together for the good of all, and the logs are sorted out at the end of the drive by means of the owners' marks—curious hieroglyphics cut in the bark or stamped into the ends, or both.

Unless the stream is unusually deep and well adapted for driving, it has been provided with a number of "splash dams," built of logs and hewn timbers,



SLUICEWAYS OF A SPLASH DAM (MINNESOTA).

which operate on the same principle as the locks of a canal, by backing the water up on rapids and other shallow parts of the river, and thus aiding in floating the logs down from the upper levels and sending them on with a rush when the gates are opened.

Above the dams long booms converge from the shores to the entrance of the sloping sluiceway, through which the water and logs must pass. When the gate is open a smooth, black body of water rushes down the sluiceway, dashing itself into foam in the rapids below. Four or five men work along the booms, directing the logs into the current as fast as they come down the stream.

They will mount a log at the upper end of the boom and ride with the utmost *sang froid* down the quickening current, changing to another log or stepping nonchalantly to safety on the boom again, just as the unwieldy craft tips up in the slope of the sluiceway. The log darts ahead in the grip of the current, and three seconds later above the roar of the water you hear the jarring shock of its impact upon the rocks in the bed of the stream. Later you see it reappear, buoyant as cork, in the swirl of the rapids far downstream. The wanigan like-

wise must run the gauntlet of the sluiceways.

The life of the river driver is full of strain and exposure, and the only thing that guards him is his own brawn and brain, well coördinated and backed by steady courage. At any time he may be called upon to risk limb or life to save his employer's property or the life of a comrade in peril.

The time of greatest danger is in working on the jams, which will form in spite of the skill and faithful work of the crews. Shutting off too much of the flow from a dam at a time when the stream is full of logs will crowd the logs together, upending some on the shallows and delaying progress until the pressure of the constantly accumulating timbers in the rear locks the whole mass like a tangle of Titanic jackstraws. (See frontispiece.) The narrow, rocky channels of a rapid, or a crook in a gorge may have the same effect, and the pent-up force of the water behind piles the logs high in air.

Frequently the whole situation depends upon one or two "key-logs," which control all the rest. The men run nimbly over the big brown sticks and under the very face of the jam, which

hangs over their heads like a beetling cliff. Prying and twisting with their peavies, they detect the key-log by its position and its tension and rigidity under the tremendous strain from the rear. They may pry it loose, or cut it out with axe or saw, or blow it out with dynamite, depending on the obstinacy of the jam and the amount of danger attendant. The jam is a treacherous thing. It may shift of itself and melt away without a moment's warning, or it may hang for weeks, defying skill and dynamite. Sometimes at the first blow of the axe on the key-log the overstrained stick parts instantly, and the whole jam leaps forward at once, taxing every resource of the men to escape destruction.

Again, they may succeed repeatedly in starting the tangle, and each time be disappointed to see it lock fast more hopelessly than before. Patiently they pick out single logs from along the shores and set them adrift, working their way upstream and leaving a narrow body of logs in the middle, extending from the key-log to the body of the jam. Then the dams are opened at full

head, with the hope that the sudden impact will crumble up the resistance and force everything past the obstacle.

If the jam is in a gorge the men are lowered from the cliffs by ropes to do their work, in order that they may be hauled out of harm's way the instant the mass begins to move, since they can have no other avenue of escape.

Thus, day after day and week after week they work their way downstream until the last rapid is negotiated safely, and the last bend of the river passed, and the sorting gap comes into sight, with the white smoke floating lazily up in the spring sunshine from the burners at the mills below. The drive is in and everybody is happy, not excepting the owners.

The sorting gap is a kind of clearing house for logs. The several drives are held in one great boom, from which the desired quantity can be released as needed daily at the various mills. Other booms extend downstream in such fashion that as a log comes along and is recognized by its marks it is guided by men armed with pike-poles into the entrance which will take it to the owner's mill. If a mistake is made the scaler



THE SORTING GAP (MICHIGAN).

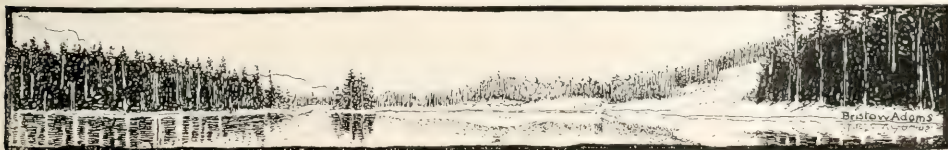


SCENE ON MENOMINEE RIVER AT MARINETTE, WIS. FORMERLY FOR A NUMBER OF YEARS SEVEN HUNDRED MILLION FEET OF PINE WAS DRIVEN DOWN THIS STREAM EACH SPRING.

at the mill is supposed to detect it and credit the proper firm.

In the old days solid citizens were accustomed to feel uneasy for several days after the drive came in. Such a visitation has been known to result in the entire demolition of a thriving young town. It was no light matter, this sudden arrival of scores of hardy, resolute men, with enormous appetites, unquenchable thirsts, five months of pent-up enthusiasm, and a winter's pay in possession. The police smiled indulgently when capers were cut, their organization being the result of a process of natural selection. Such of their number as had declined to smile on previous occasions became unable to act longer as police. Some of them were unable even to smile.

Today the drivers do not "take the town apart" quite as freely as formerly, but the arrival of the drive is still an event of the year. The drivers are popular with several classes of the people, and they know it. Not only does their unspent pay account for part of their cordial reception, but the young women seem to approve of them as men returned from a hard-fought campaign, and they are the heroes of boyhood in sawmill towns. Every youngster's ambition is to "birl" (*i. e.*, cause a floating log to revolve by treading it) as the local champion does, and to that end he stags off his overalls and practices slyly, at the imminent risk of drowning, where the big sticks lie in the ponds at the sawmills. Their fathers and elder brothers trained in the same school.



REPORT OF THE FORESTER FOR 1903.

WORK OF THE BUREAU OF FORESTRY. ITS OPPORTUNITIES AND ITS NEEDS.

THE annual report of Mr. Gifford Pinchot, Forester of the Department of Agriculture, is a brief document, but one of unusual interest to the public, if one may judge by the reviews and comments which have appeared in the press of all parts of the country.

Prefacing the body of the report, which is a condensed description of the work accomplished by each of the various sections during the year previous to July 1, 1903, Mr. Pinchot makes these significant statements, showing the rapidly increasing influence and responsibility of the Bureau of Forestry and the need of increased means and experienced men to accomplish its ever-growing tasks, so essential to the future welfare of the nation:

"No previous year has seen such progress in forestry as the last. During this time public sentiment in favor of forestry became more marked, and practical forest work in the woods was better in quality and greater in amount than ever before. But great though the progress was in comparison with other years, actually it was small. The saving of the forests by wise use is but little nearer than it was a year ago, except for the wider spread of a knowledge of the nature and objects of forestry. The means available are yet too feeble to make much impression on the gigantic task of preventing the destruction of the lumber industry, the fourth among the great industries of the United States, and of using conservatively the forests which supply wood and conserve water for the use of the nation. The interests which these supplies serve and maintain are so vital to all our people that it can not be in question whether they shall be preserved, but only how best it can be done. The present provisions are wholly insufficient.

"The very rapid progress of the sentiment for forest preservation during the last year has been nowhere more conspicuous than in the Western States.

The greater part of it may be traced directly to the growing desire for development in irrigation which followed the passage of the national reclamation law. Except where special interests complicate and obscure the issue, the public opinion of the West has become unanimous in favor of forest preservation for the protection of the water supply, and practically so for the perpetuation of the supply of timber.

"The necessity for the creation of forest reserves for their influence on the stream flow and timber supply is being better understood and is steadily receiving greater support where once there was opposition to the policy. The people of the West have not only come to understand that existing forests must be preserved if irrigation is to maintain its continued development, but they are realizing also the importance of reserving lands once covered with forest, but now denuded, and the essential necessity that the government should reclothe them with trees.

"Decidedly the most important development of the year in forestry has been the awakening of the great lumber interests to the necessity for practical forestry and the hearty coöperation they have begun to give to the efforts of the government for forest perpetuation. At the convention of the National Lumber Manufacturers' Association, held in Washington, more attention was given to forestry than to any other subject. The convention expressed itself in favor of the perpetuation of forests by wise use, and gave evidence of its good will by visiting the Bureau of Forestry in a body. Members of the association have since that time begun active coöperation with the Bureau with the object of forest preservation, and it may fairly be said that forestry has become a live issue in the minds of the great timber-land holders of the United States.

"Only less important is the recent tendency of the railroads of the United

States to consider the future of their timber supply and to take measures for its perpetuation. Railroads are among the greatest consumers of timber in the United States, and the preservation or destruction of vast areas of forest will depend on the attitude they assume toward this question, which is not less vital to them than to other users of wood.

"The growing tendency of the Bureau of Forestry to devote its energies rather to government work than to the assistance of private owners was marked during the past year. In spite of the rapidly increasing demand for assistance under the terms of Circular No. 21 on the part of private owners, a very large proportion of the work of the Bureau was given directly to government forest problems on public land. But the greater part of the forests of the United States are and doubtless will remain in private hands, and their preservation is essential to the national safety and prosperity. While, therefore, it is right that the Bureau of Forestry should meet first of all the demands for strictly government work, it can not neglect the re-

quests for assistance from private owners without most seriously endangering the central object of its existence, which is the perpetuation of the forests of this country by wise use.

"The widening of the field for practical usefulness of the Bureau in coöperation with private owners was shown by the growing number and the eagerness of such demands. In meeting them it is the public rather than any private interest which is at stake. It is plain that a great opportunity has presented itself at a critical time. If this Bureau can be equipped to meet the demand before destruction has gone too far, the extensive protection of woodlands by the practice of forestry will certainly be attained. The only obstacle is present inability to handle the work. The Bureau is face to face with a situation with which it is unable to cope. Not only are the demands already made upon it far beyond its present capacity to meet, but there is grave danger that vast areas of the forests will have disappeared before the Bureau of Forestry can be made ready to use the opportunity to save them."

REMODELING NEW YORK'S FOREST POLICY

SITUATION AT ALBANY AND EXTRACTS FROM THE REPORT OF THE SPECIAL COMMITTEE OF THE SENATE ON THE FUTURE POLICY OF THE STATE IN RELATION TO THE ADIRONDACKS AND FOREST PRESERVATION.

THE present status of forest interests in New York State is a matter of speculation among those who desire to see the Adirondacks and the Catskill Mountain forests made safe, permanent, and profitable.

The extensive damage done by fires in these forests last spring has brought the question of the welfare of the state forests before the public with more prominence than ever before, and has resulted in the appointment of a special committee of the senate to investigate forest matters and make recommendations for changes in the present forest laws.

Several circumstances combine to render the enactment of a forest code

satisfactory from the forester's point of view a very uncertain matter in New York.

There is a clause in the state constitution which forbids any cutting or removal of even dead wood from state lands, consequently throttling all silvicultural work except planting.

There is the uncertain attitude of Governor Odell, who vetoed the bill for maintenance of the State College of Forestry and interrupted the demonstration work in the Adirondacks, but whose last message seems to acknowledge very little reasonable ground for his action.

There are the powerful railroad companies, which naturally do not wish to

take expensive precautions unless driven to it.

There is the Legislature itself, many of whose members, ignorant of the processes of forestry and mindful of past jobbery, are extremely chary of voting for measures which have not been assured of success by trial in other states.

Until recently New York has been more progressive and far-sighted in forest matters than any of the other states. The creation of the Adirondack and Catskill Mountain Preserves was a long step in advance, but it must be followed by more progress if the work is to be kept abreast of that now inaugurated by California and New Hampshire.

Some of the more pertinent portions of the report of the Special Committee on Forest Policy read as follows:

To the Senate :

The special committee of the senate appointed to inquire and report upon the future policy of the state in relation to the Adirondacks and forest preservation respectfully report that they have had several hearings in the city of New York and in Albany which have been well attended, and after giving careful attention to the suggestions made and to matters of public record beg leave to submit the following report :

The total acreage of the Adirondack Park as now laid out is 3,226,144 acres, of which the state owns 1,163,414 acres. Private preserves contain 705,914 acres. The remaining 1,356,816 acres are owned by private persons and business corporations. To preserve existing forests on these lands and to reforest tracts that have been denuded by man or devastated by fire is the unanimous and earnest desire of the people of the state.

There is some diversity of opinion as to the best means of executing the public will in relation to this interest, but there are three measures of immediate and available relief which, in general outline at least, have the unanimous approval of our people. These are a resumption of the former state policy of acquiring further holdings of Adirondack lands by purchase, the estab-

lishment of a system of fire protection sufficiently effective to prevent great forest fires, and the reforestation of barren and denuded tracts.

PURCHASE OF LAND.

Ownership by the state is the most effective means of preservation. It is much easier for the state to regulate and control its own holdings than to influence private owners to institute rational forestry methods. Prejudice does not exist against state ownership, and its holdings are not subjected in so great a degree as private holding to the perils of incendiarism. It is in keeping with the policy of maintaining these forests in trust for the general good—for lumber and water supply, as a regulator of climate and rainfall, and as a health and pleasure resort of incomparable value.

Former investments by the state in these lands are, owing to the great rise in their value, worth vastly more than they cost, with interest added. While prices in the future will be higher, the scale of prices is sure to be an ascending one for an indefinite period, and purchases made within the next few years are likely to be as profitable as purchases hitherto made now are. Waste lands can be most easily acquired, but special effort should be directed toward the acquisition of tracts of exceptional value as a watershed or for their natural scenery, as wooded mountains and shores of lakes and rivers. The cost can be properly reduced by allowing reservations of mature soft wood to the seller, while the hard wood, which is of much slower growth and of less value, will remain. A definite policy of acquiring the entire Adirondack Park should be adopted and carried into execution within a reasonable time, due regard being had to the rights of private owners and special privileges extended to present owners who cooperate with the state in forest preservation.

FIRE PROTECTION.

The statement in the annual report of the Forest, Fish, and Game Commission shows the loss by fire in the Adirondack and Catskill forests during the year 1903 to be as follows :

Adirondack Forest Fires, 1903.

Total acres of forest land burned . . .	464,189
Total value of standing timber, logs, pulpwood, and buildings burned . .	\$846,082
Total number of days' labor employed in fighting fire	77,290

Catskill Forest Fires, 1903.

Total acres of forest land burned . . .	36,329
Total value of standing timber, pulpwood, etc., and buildings burned . .	\$37,934
Total number of days' labor	4,492

The cost to the state and to the towns in fighting fires will not be less than \$185,000 for 1903, so that the total money loss from forest fires during that year will amount to more than \$1,000,000. Owing to the vigilance and efficiency of the forest commission, only 12 per cent of the fires occurred on state lands, but the loss to private owners is directly injurious to public interests. Four hundred and sixty-five thousand acres were burned over during the year, and it is apparent that unless the recurrence of such a catastrophe can be prevented, all efforts toward forest preservation will be in vain. These fires occur only in years of exceptional drought. They are due to railroads, to burning fallows, to the carelessness of campers and fishermen, and to incendiaries. There was a general concurrence of opinion among those who appeared before the committee in attributing 50 per cent of these fires to railroads.

The railroads in the Adirondacks are: the Mohawk and Malone (N. Y. C. & H. R. R.), running through forest lands 127 miles from Forestport to Owls Head, and within the Adirondack park 91 miles from Otter Lake to Rainbow; The Carthage and Adirondack (N. Y. C. & H. R. R.), in forest lands in or near the park, 29 miles; the Racquette Lake (N. Y. C. & H. R. R.), 18 miles, wholly within the park; the New York and Ottawa, 49 miles in forest lands from Dickenson Center to Tupper Lake, and 29 miles within the park; the Chateaugay (D. & H.), from Chazy Lake to Lake Placid, 55 miles, of which 17 miles is in the park. A map showing the burned areas in the Adirondacks, prepared by the Bureau of Forestry at Washington, is made a part of this report through the courtesy of that department. It was veri-

fied before the committee by the testimony of the official who prepared it. From this map it appears that fires raged substantially throughout the entire length of each of these railroads, except the Racquette Lake Railroad. Of the 127 miles of the Mohawk and Malone, there was scarcely 15 miles free from extensive conflagrations on either side of its track. None of the other lines except the Racquette Lake is noticeably better, and one is distinctly worse. It is difficult after examining this map to credit 50 per cent of the fires to other causes than railroads.

From the testimony of the officials of the State Commission on Forestry, the Forest Department at Washington, and experts from Yale and Cornell Universities, the committee is satisfied that reasonable precautions would effectually prevent railroad fires. They are substantially unknown in European forests, notwithstanding equal exposure. Not a single fire occurred along the 18 miles of the Racquette Lake Railroad, where petroleum is used. While fires would not occur except for the use of coal, they are only set from engines burning coal by reason of gross carelessness and lack of reasonable precaution. The lack of reasonable precaution is further shown by insufficient fire patrol. General slackness is promoted by inadequate laws fixing the liability for fire damage and imposing official restraint and supervision for fire prevention. There is no reason why damage to the forests by fire occasioned by carelessness should not be collected equally with damages suffered by private owners in more settled sections. In fact, the obligation to the state to avoid damage in such cases is as much greater as the interest of the state and its people is greater in their own forests than in private lands. Legislation should be enacted requiring strict accountability in all such cases.

Expert opinion is unanimous to the effect that with reasonably efficient laws providing against careless or wanton fire setting, a system of fire patrol will prevent extensive conflagrations. Such a patrol should be established along railroads and in sections frequented by campers and fishermen. As the need of

this precaution exists only two months of the year, and in its full extent only in years of drought, the patrol should be organized as far as possible from the present force in the Forest, Fish and Game Commission, but with such additions as are absolutely required to make it effectual.

The interest on the amount of the losses from fire in forests during the year 1903 would be adequate to maintain for all time a fire patrol service at what are now exposed points. Regular stations for dumping fire-boxes should be established and strict regulations for their exclusive use enforced. The only true way to fight fires is to prevent them.

REFORESTING.

Closely related to fire prevention is reforestation. The dead timber and debris on denuded and burned lands are, in the absence of green timber, a standing menace from fire—a great menace in exceptionally dry seasons and a menace at all times. Such tracts burn over repeatedly until the debris is completely consumed. The tendency is for such areas to enlarge their borders, and every fire has an ill effect upon the soil. The only remedy is tree planting. Experiments already made by the Forest Department show this to be entirely practicable, the cost varying from three to five dollars per acre. If planted with soft woods, it will produce a forest cover furnishing all of the benefits of a forest except merchantable timber in from twenty to twenty-five years, and merchantable timber in from thirty to forty years. Under the terms of the forest amendment to the constitution as thus far construed, the state government is powerless to remove or disturb this dead timber and debris, even though necessary to enable it to plant young trees. An amendment should, in our judgment, be adopted so far modifying its terms as to permit the legislature to authorize the destruction or removal of the dead timber by the state itself through its own agencies and employés, and not by contract, for the purpose of reforestation.

FEDERAL AID.

The national government, perceiving

that an intelligent public sentiment is an indispensable prerequisite to forest preservation, has adopted the policy of coöperating with the states in defining, classifying, and describing their forests with a view, first, to determining the best means of extending and improving the forest cover for its protective value; second, to preventing fires, and, third, to managing forests on common-sense financial principles. The Bureau of Forestry in the Department of Agriculture proposes to undertake this work in New York at the joint expense of the state and nation, and undertakes to do the work within two years. An appropriation of \$10,000 the first year and \$5,000 the second year is requested, and your committee recommend that the request be granted. Similar appropriations have already been made by the States of California and New Hampshire.

In making the foregoing recommendations, the committee is aware of the uncertainty and doubt, not to say suspicion, hitherto revealed in the public mind of any and all plans for the improvement and preservation of our forests based upon any modification of existing constitutional provisions. So long as great commercial interests desire forest products, and the ownership and exclusive possession of vast tracts is sought by wealthy persons as game preserves and forest parks, there will be need of a vigilant and powerful public sentiment to protect the public interest.

We are conscious that the measures proposed are not in any sense a solution of the problem of establishing a rational system of forestry which shall increase the natural forest growth as the cultivation of wild fields multiplies their natural products. We shall be content if measures can now be adopted to preserve what we have, and to undertake the reforestation of tracts recently devastated. Such a course will serve to create in the public mind an intelligent and discriminating acquaintance with the problems in hand, to prepare the way for the future development of forestry on public and private lands, which shall secure to the people of the state the benefits of abundant and flourishing forests.

We summarize our recommendations as follows:

First. The passage of an act definitely fixing the limits of the Adirondack Park so as to include the contiguous forests which the park was established to protect.

Second. A resumption of the state policy of purchase of lands in the forest preserve.

Third. The enactment of laws requiring adequate precautions against fire setting by steam engines, a stricter accountability in damages of all parties setting fires carelessly or wantonly, and the establishment of a system of fire patrol.

Fourth. The adoption and execution of a plan of reforestation of denuded state lands in the Forest Park.

Fifth. A constitutional amendment empowering the legislature to pass laws for the destruction or removal of dead timber and debris on burned areas through agencies and employés of the state, and not by contract, for the purpose of reforestation, and for the sale

of lands owned by the state in forest-preserve counties outside of the park limits when unsuited for a forest preserve, and the application of the proceeds to the purchase of lands in the park.

Sixth. The passage of an act defining the boundaries of the Catskill Park.

Seventh. An appropriation of \$10,000 this year and \$5,000 next year, to be used with a like amount appropriated by the national government in defining, classifying, and describing the forests in the forest preserve.

As your special committee is identical with the Senate Committee on Forest, Fish, and Game, committee bills will be reported during this session to cover the recommendations made.

ELON R. BROWN,
WM. W. ARMSTRONG,
J. P. ALLDS,
FRANK J. LEFEVRE,
W. L. BROWN,
WM. TOWNSEND,
LUKE A. KEENAN,
Special Committee.

RECLAMATION OF SALT AND ALKALI LANDS.

SHOWING APPLICABILITY OF RECENT TRIALS OF SOIL-WASHING IN EGYPT TO SIMILAR PROBLEMS IN THE UNITED STATES. COMPILED FROM RECENT PUBLICATIONS

OF

THOMAS H. MEANS,

IN CHARGE OF ALKALI RECLAMATION, BUREAU OF SOILS.

THE soils of Egypt have been farmed for thousands of years. There are at the present time 6,250,000 acres of irrigated land, and it is supposed that under the Pharaohs a much larger area was under cultivation, for at the present time one-third of the irrigable land is uncultivated. At the time of the Arabian conquest, in the seventh century A. D., a large portion of Egypt was devastated, the banks of the old basins

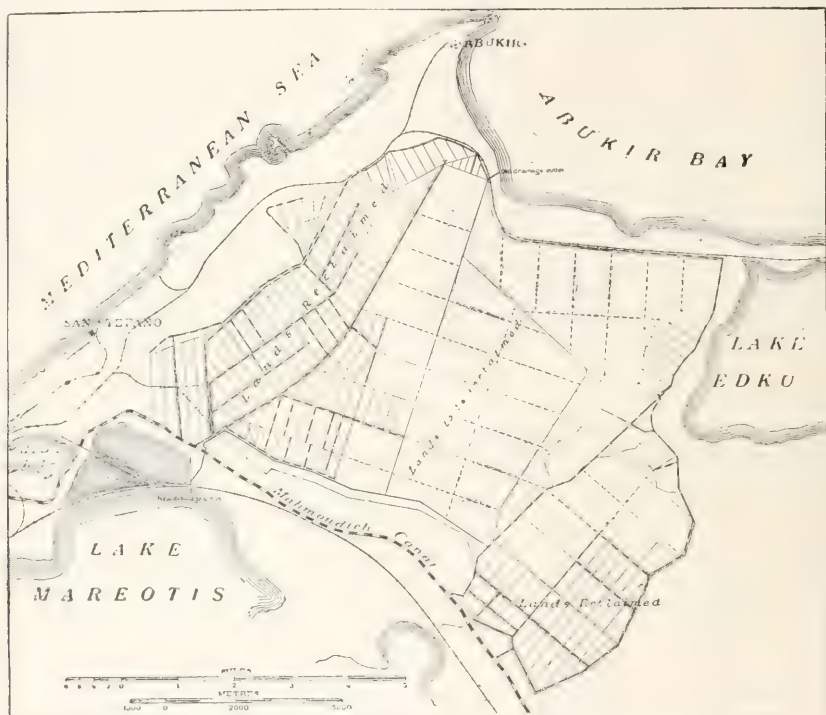
were broken, and large areas were flooded with salt water or left idle. The land thus abandoned was subject to evaporation from the surface, as a consequence of which over 1,500,000 acres of land have been so damaged by the rise of salt and alkali that their cultivation is no longer possible. These lands lie in a fringe around the lower edge of the Delta and extend from Alexandria to Suez.

For the use of the illustrations in this article we are indebted to the courtesy of the Bureau of Soils, U. S. Department of Agriculture.—EDITOR.

Except for those small areas of land lying too high to be reached by the ordinary floods of the Nile, the ancients used only the basin system of irrigation. This method consists of flooding the land to a depth of from 3 to 5 feet at the season of high Nile and of maintaining this depth of water for about six weeks, when the water is drained back into the Nile and the seed is sown, without plowing or other cultivation, on the surface of the newly deposited mud. In this way but one crop could

the capillary forces were unable to return them to the surface before the next annual flood. Upon the abandonment of this method, however, the movement of soil moisture was entirely from below, and the soluble salts gradually accumulated at the surface.

The first step toward reclamation is the construction of canals for irrigation and of ditches for underdrainage. Irrigation water is taken by a large canal, which subdivides and ramifies over the entire area to be irrigated. The drain-



ABUKIR TRACT, WHICH IS BEING RECLAIMED FROM SALT.

be grown each year. The higher lands were covered only by the highest floods, or only eight or nine times in a century. During the remaining years these lands were irrigated by lifting the water from the canals or the river. It can readily be seen that there was little opportunity for the accumulation of alkali salts so long as the basin method of irrigation was kept up, for the large amount of water which washed over and through the soil each year either removed the salts or washed them down so deep that

age water is drawn off and discharged into a lake or the Mediterranean.

The accompanying plans show two methods of placing the canals and drains, both of which are in general use.

By the first plan (Fig. 1) the secondary drains run half way between the secondary canals, and into them the tertiary drains or laterals run from each side. These tertiary ditches are 150 meters (492 feet) long, 80 centimeters (31½ inches) deep, 25 centimeters (9.8

inches) wide at the bottom, and 125 centimeters (49 inches) wide at the top. The distance between the drains is 50 meters (164 feet). These lateral drains subdivide the land into areas 150 by 50 meters (492 by 164 feet), containing about 1.83 acres. This tract is called a "gata" and is the unit used in renting the land.

The second plan (Fig. 2) shows the system of canals and drains in use in other parts of the reclamation work. The main difference between this and the first plan is that the secondary drains run beside the secondary canals and

general expenses and cost of pumping plant.

LEVELING THE LAND.

One of the most essential parts of the reclamation system is the leveling of the land so that each field or "gata" will be perfectly level, and when flooded uniformly covered. There are two methods of leveling in use at Abukir. The first method is to use scrapers drawn by bullocks or buffaloes. These scrapers are very similar to the common scoop scraper in use in this country, but are of wood braced and protected by iron bands and



FIRST STEP IN RECLAMATION. DITCHING ALKALI LAND.

serve as infiltration drains to catch the water which seeps from these canals. The tertiary drains are 300 meters long.

In this plan a smaller amount of ditching is necessary, and where there is enough slope to permit the use of such long drains, this system is to be recommended.

The land is so level that little fall can be had. The main drains and canals have a fall of about 1 in 20,000, or $3\frac{1}{8}$ inches to the mile. The laterals and sublaterals are almost level.

The cost of this canalization is about \$12.50 per acre. This includes also

with an iron cutting edge. Work with these is slow and laborious, but where labor is as cheap as in Egypt, and where it is so difficult to teach the natives to handle improved machinery, these home-made scrapers have proved very successful.

The second method of leveling is that of leveling under water by drawing a long board, on which the driver stands, across the field, while it is flooded with water to a depth of 3 or 4 inches. This method is cheaper than the first method, but can not be used the first year the land is flooded, because the soil is then very soft and boggy.

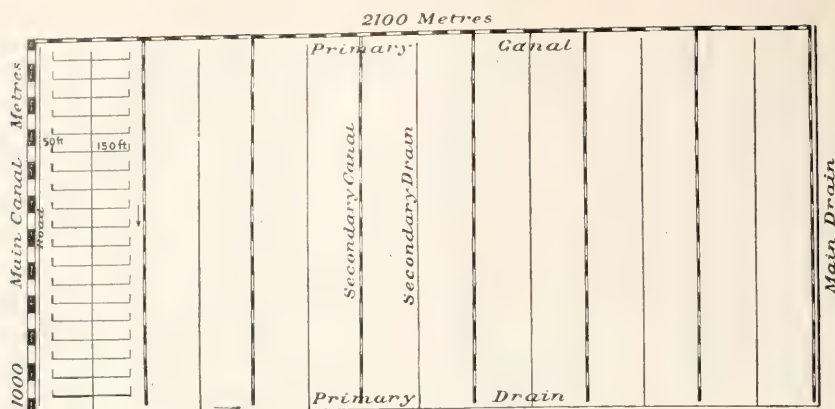


FIG. 1.—FIRST PLAN OF DRAIN ARRANGEMENT.

FLOODING THE LANDS.

After the canals and drains are dug and the land is sufficiently level to permit uniform flooding, water is turned into each gata to a depth of 4 inches. When possible this depth is maintained until the land is ready for a crop, but during the season of low water in the Nile the use of water for reclamation purposes is not permitted, so that there are times during the year when this land has to remain dry.

During the time the water remains upon the land the salt which the soil contains is dissolved and carried away by the drainage water. The drainage water is very salt and is said to contain at times over 10 per cent of sodium chloride.

On some of the land one season's washing is sufficient, but as a rule the

land is washed two years before the soil is sweetened sufficiently to permit crop growth. If the first season's washing has not sufficiently sweetened the land, it is plowed during the summer months, when water is not abundant, in order to reduce the surface evaporation to a minimum.

At the end of the second year the land is usually sufficiently sweetened for some crop. Samples of the soil are examined for the percentage of sodium chloride content, as experience has shown that this is an indicator of the condition of the land as regards crop growth. The first crop to be grown is barnyard grass (*Panicum crus-galli*), called by the natives "dineba." The seed of this plant is obtained from the screenings from the rice mills, and as it is a by-product it is very cheap. If the growth of this grass is good, the

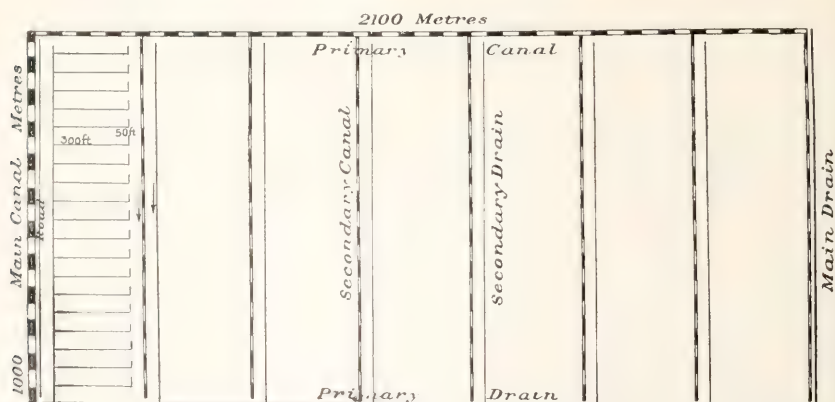


FIG. 2.—SECOND PLAN OF DRAIN ARRANGEMENT.

soil is considered in a condition for the introduction of other crops, and as a rule Egyptian clover is then planted. While these crops are on the ground the land is heavily flooded, as much water being used as the plants will stand, so that there is no opportunity for the alkali that has been washed down to return to the surface.

From all the information which could be gathered, it seems that the value of barnyard grass and Egyptian clover as reclamation crops is not due to the fact that they are able to withstand a large amount of salt, but to the fact that they are very shallow-rooted, growing in the immediate surface soil which has been washed free from salt, and are adapted to a very wet soil. Egyptian cotton, however, is a deep-rooted crop, its roots growing down into the subsoil, which is still charged with salt. Therefore the Egyptian cotton is actually more resistant to salt than the other two reclamation crops, though the best grades of cotton are not produced on salt lands.

The total cost of this reclamation work is given as \$18.30 per acre, but it varies from this amount up to \$25 or \$30 per acre. This latter amount, however, includes the cost of the original purchase of the land, cost of live stock, tools, buildings, taxes, water distribution, management, seed, harvesting, and all expenses incident to the work. It will be seen that the greater part of these expenses would be incurred in taking up new land anywhere, and should not be included in the cost of actual reclamation from salt. It is very difficult to obtain figures as to the actual cost of ditching, washing, and farming until the land can be made to pay expenses and a reasonable interest on the capital invested, but it is thought that this figure does not exceed \$15 per acre.

It should be remembered that the cost of labor in Egypt is very low. The ordinary farm laborer receives \$5 per month, and labor by the day is paid 10 or 15 cents. Women and children take part in the minor field operations and receive from 3 to 5 cents a day. Such labor is, however, not as efficient as American labor, and the difference in

cost is not so great when this fact is considered. The engineers in charge of the Abukir reclamation estimate the cost of digging the lateral ditches at 3 cents per cubic yard, a figure much below that for similar work under American conditions; but where tile are used our ditching can be done as cheaply, for ditches for tile are not dug so wide as open ditches and our workmen are more efficient.

Thoroughly reclaimed land is worth from \$200 to \$300 per acre, the latter price having been refused for a large tract recently reclaimed at Abukir. Much of the newly reclaimed land is being rented to individual farmers at from \$10 to \$30 per acre per year, depending upon the state of the reclamation.

CROPS GROWN DURING RECLAMATION FROM ALKALI.

Crops are generally planted the first year of reclamation. In soils where the alkali content is high, it is necessary to wash the land six months or a year. The first crop planted is samar (*Cyperus laevigatus*), a rush used for mat-making.

This plant is set out at intervals of 18 inches and is kept constantly under water, much as rice is grown. It has an advantage over rice in that it can go without water for a period of ten or twenty days and suffer no damage. Where the land is very salty, a poor stand and yield is often the result, but almost invariably the plant yields enough to be profitable, and where good yields are secured the product is worth from \$50 to \$75 per acre. As stated, in nearly every case a profitable crop of samar is obtained the first year. On the worse land, however, it has sometimes been necessary to wash the soil a full year before a crop could be grown. This is particularly true of those spots which contain sodium carbonate or black alkali.

After a crop of samar has been grown, the land is in much better condition, and various crops are then planted, according to the taste of the cultivator. Rotations have been adopted for use during the reclamation, of which the following have proven useful and successful:

First. Where the land is strongly alkaline: 1, washing; 2, samar; 3, cotton. The growth of the cotton indicates the extent to which the reclamation has gone. If a good stand is had and a yield of good fiber is obtained, a new rotation is planned to suit the farmer's taste. If cotton does not do well, the land goes again into samar and receives a further washing.

Second. In land which contains an average amount of alkali: 1, samar; 2, rice; 3, cotton; or, 1, rice; 2, samar; 3, cotton.

Third. In land which does not contain a large excess of soluble salts, cotton comes earlier in the rotation and is followed by less resistant crops, as: 1, samar; 2, cotton; 3, corn. For a number of years after the reclamation has gone on, it will be found advantageous to grow either rice or samar every three or four years, in order to wash from the soil the alkali which has risen above the drains.

The cost of ditching per cubic yard can be calculated from the following contract prices for carrying on the work:

Main canals ..	\$0 06½
Main drains.....	10½
Primary drains.....	04½
Secondary and tertiary drains.....	03½

One of the greatest obstacles to more rapid reclamation has been the lack of population. With the deterioration of these lands the fellahs left and the re-peopling of the villages is slow. For a time the fellahs had little faith in alkali-land reclamation, but gradually the success of the method of reclamation became evident, and now settlers are easier to obtain.

Land once thoroughly reclaimed gives no further trouble from alkali if farmed with intelligence, but land partially reclaimed reverts to its damaged condition in a few years. It has been found more economical to wash land four years and be sure of thorough reclamation than to attempt the cultivation of half-reclaimed



ALKALI SPOT APPEARING IN A COTTON FIELD AS A RESULT OF ALLOWING LAND TO LIE IDLE.

soil, which invariably develops salt spots that spread from year to year.

Upon the completion of the reclamation, cotton, corn, clover, alfalfa, sugar cane, and all crops grown in the district can be grown without fear of a rise of alkali, but the partially reclaimed land is fit only for alkali-resistant crops, or crops which will grow in standing water.

SUMMARY OF RECLAMATION METHODS.

There are three methods of alkali-land reclamation in use in Egypt. Each of these methods is successful under the conditions appropriate for its use, and all are worthy of being tried in America.

1. *Flooding with open drains, as has been described.*

2. *Colmatage or Warping.*—This method of reclamation consists simply in flooding land with muddy water long enough to allow the mud to settle, after which the clear water is drawn off and more muddy water run on. Very little attention is paid to drainage, except in so far as surface drains are dug to carry away the clear water. The popular impression prevails that by this method the alkali or salt is covered up with sufficient good soil to permit plant roots to thrive. As a matter of fact, the efficiency of the method depends much more on the fact that the alkali is washed down into and mixed with the sub-soil, so that its concentration at the surface is diminished. The total amount of alkali in the soil is very slightly reduced, and when conditions again become favorable for the rise of the alkali it returns to the surface and proves as troublesome as before.

3. *Flooding with Tile Drains.*—This method has only been tried experimentally in Egypt, but promises to be the most rapid and effective way of reclaiming the land. Tile drains are placed 30 inches deep and 35 feet apart, at a cost of \$30 per acre.

In the application of these methods of reclamation to American conditions there are a number of factors which enter into the problem and make necessary certain changes. American farmers have a well-grounded dislike to open ditches in fields. They take up a large amount of valuable land, require an annual outlay in cleaning and deepening, necessitate the building and annual

repair of bridges, and prevent or hamper the use of machinery in agricultural operations. Tile drains take up no room, render no land unavailable for cropping, require little or no repairs if properly laid at the start, and are efficient for many years. One hundred feet of open ditch 7 feet wide occupies 700 square feet of land. The value of this, at \$100 per acre, would be \$1.61. The cost of digging 100 feet of open ditch of this width, 3 feet deep, is at least \$4. The cost, in our Eastern states, of digging, laying tile, filling the trenches, and purchase of 4-inch tile for 100 feet of drain is about \$4, so that there is a difference of \$1.61 per 100 feet in favor of the tile. If allowance is made for cost of bridges and annual cleaning of open ditches, the difference will be still greater.

The soils in arid America are generally light in character and do not stand well in bank, so that great trouble would be experienced in maintaining small open ditches.

For these reasons alkali-land reclamation by means of open ditches is not to be recommended for general use. In the larger drains, where very large pipe would be required, open ditches may be used, but in a great many localities some kind of protection will be necessary to strengthen the banks and prevent their caving.

The irrigation season, except in certain parts of California and Arizona, is shorter than in Egypt, and in order to reclaim land within a reasonable length of time it will be necessary to place drains closer together. In this way the land will be reclaimed in a shorter time, because a greater quantity of water can be run through the soil in a given time. In an experiment on 40 acres now being carried on in a loam soil near Salt Lake City, Utah, the tile were placed 150 feet apart. This seems to be a good average distance at which to place tile. As the experiment progresses more definite information regarding the time required for reclamation can be given.

Prof. Milton Whitney, Chief of the Bureau of Soils, has lately expressed himself as follows in regard to the practicability of soil-washing in the West:

"The subject of alkali has been a source of much anxiety to our western



PARALLEL DRAINAGE DITCHES. ONE MAY BE EMPTIED AND CLEANED WHILE THE OTHER CARRIES THE DRAINAGE WATER.

people, and the vast injury that has been done through the occurrence of alkali has prejudiced outsiders in irrigation enterprises to such an extent that in many communities the subject has been exceedingly unpopular, and any reference to it in connection with certain localities has been vigorously opposed and criticised.

"It must be recognized that alkali occurs in all arid countries, and it is a problem for consideration and suitable control by the people of irrigated arid districts, as the suitable drainage of rice lands or corn and wheat lands has been in other parts of the humid regions.

"The experts of the Bureau of Soils firmly believe that the alkali lands of this country can be economically reclaimed, and that the damage from alkali is unnecessary and will not result if proper precautions are taken. Furthermore, it is a well-known fact that in most cases alkali accumulates in the most fertile soils, and the presence of alkali in the soils of arid regions should indicate to the people as a rule a high degree of fertility, provided proper methods of handling the soil are adopted.

"The publications of this Bureau have been recommending drainage for

the reclamation of these waste lands. This recommendation had previously been made by other writers on the subject, and all who have given this matter any thought are unanimous in the opinion that drainage will solve the problem.

"As no work of reclamation by drainage has been carried on to completion in this country, it is impossible to say what the actual cost of reclamation would be, but very reasonable estimates based upon the cost of land drainage in the humid states have placed the probable cost of alkali land reclamation at from \$10 to \$30 per acre. In Egypt large areas have been reclaimed and are now producing crops, and from figures given by the engineers in charge of this work the cost of reclamation can be readily calculated.

"The results obtained in Egypt thoroughly warrant the statements made as to the practicability of reclamation by drainage, for it will be seen that the cost of reclamation is so low that much of the land of the West now lying idle on account of alkali or seepage water can be made to produce crops in from one to three years, with an expenditure much below the value of the land when reclaimed."

THE FUTURE OF FEDERAL FOREST RESERVATIONS.*

BY

EDWARD A. BOWERS,

SECRETARY OF THE AMERICAN FORESTRY ASSOCIATION, FORMERLY ASSISTANT COMMISSIONER OF THE GENERAL LAND OFFICE.

THE existing federal forest reservations were created only after a long struggle. Those of us who were engaged in the efforts that finally resulted in the passage of the act of 1891, authorizing the creation of forest reservations by presidential proclamation, and the act of 1897, which inaugurated their administration in accordance with sound ideas of forestal management, recollect how we were constantly met with the honest contentions of many men residing in the regions where it was proposed to create these reservations, with the statement that the whole idea was impracticable. They contended that it was physically impossible to protect such great areas from destruction by fire, or to measurably prevent despoliation of the public timber by persons cutting it without warrant of law. They further said that the withdrawal of such large areas of land by the federal government, thus excluding it from state taxation, was a hardship upon their respective states, without any corresponding benefit to the states, and maintained that the pioneers who were developing the country were entitled to the same free use of timber and of the range as had been accorded to their forerunners. In short, they felt that the whole idea was a fanciful emanation from the brains of eastern enthusiasts, who knew nothing whatever of the real situation.

While some converts have been made among the residents of the states where these reservations exist, I fear that too many of their citizens would still indorse the above objections to forest reservations, and for this reason it seems to me that the most important thing to

insure the future success not only of these reservations but also of a forestry policy by the United States, lies in showing that these contentions are without foundation, and thus convert the population most immediately interested in the future of the federal forest reservations. How can this be done? To this question there seems to be the one answer which has thus far prevailed in the development of the United States—that is to appeal to the intelligence of our people and educate them as to what the *real* purposes of these reservations are; to show them that the reservations are of vital interest both to the people in their vicinity and also to the more remote communities far down the streams that head in the reservations. In this campaign of education constant and repeated explanation that these reserves are created for the *use* of their forests and for the regulation of the streams must be made.

In emphasizing this feature that the reservations are created for practical purposes, it seems to me that the idea which to some extent prevails, that they are created for their natural beauties and as game preserves, should be minimized. While the reserves will naturally become the resorts and homes of our wild animal and bird life, and, so far as it can readily be done, these should be protected, still it must not be forgotten that the primary purpose of the forest reservations is a practical one. They are created for the purpose of supplying wood material perpetually to the people of the United States and of maintaining natural water conditions so as to make extended irrigation more and more possible, and, by thus maintaining

* Paper read at the summer (1903) meeting of the American Forestry Association at Minneapolis, Minn.

an equable flow in the streams throughout the year, to furnish water for domestic and stock purposes. They are not under the terms of the law* created for the protection of game or the preservation of wonderful natural objects, although these may be incidentally accomplished by the creation of the reservations. These pleasurable and esthetic purposes must be cared for by the creation of the national *parks*, which are to be the playgrounds of the people, while the *forest reserves* may be said to be their woodlots and natural reservoirs. I should like to see this distinction more generally appreciated.

Perhaps the strongest single ally in the maintenance and extension of the existing reservations will come from their association with the important irrigation projects now just being inaugurated by the federal government. The men in charge of these projects are fully alive to the important assistance that the forest reservations are destined to be to the cause of irrigation. When the people generally in the arid regions fully appreciate this, we may feel certain that the future of the forest reservations is assured, for no reservoir made by the hand of man can equal in cheapness and usefulness a great forest.

The prevention of floods is of the greatest importance, and it is not at the mouth of a river that floods can be prevented, but at its source. If the water is allowed to rush down in a flood, vast quantities of detritus will be carried down to constantly fill the river bed below, thus raising its bottom year by year and compelling a corresponding raising of the levees, to which every added foot of height is added danger of

breaking. Of the large amounts appropriated for "river and harbor improvements" a portion might well be expended in creating and developing forest reservations. When we consider how widely the people of the United States are annually made to suffer loss by floods, we may feel certain that an intelligent public opinion will demand the most careful supervision and care of every agency tending to prevent these floods. It remains, then, only for the forester to demonstrate how essential the maintenance of forests at the headwaters of the great streams is in preventing floods to bring another great element of support to the forest reservations in the future.

This suggests at once that the problem we are dealing with is not generally a state question, but an interstate one; that it can not be properly cared for by any state legislation, but by its inherent conditions must usually be left to the federal government. Therefore these forest reservations, created to conserve as well as to furnish timber supplies, will in all probability remain *federal reservations*. In their development national questions must be considered paramount. While it is to be hoped that in all of the states having forest lands at the headwaters of streams there will be established forest reservations, the title to such lands having passed into the hands of private owners, this can not be expected at an early date. When such reservations are made, some plan for their administration in consonance with the purposes of the federal reservations must be worked out. The future holds here a wide field for constructive legislation.

Let us now consider some of the more detailed developments that the future has in store for the forest reservations. The first is a gradual determination of their permanent boundaries. When many of these reservations were proclaimed, the regions where they are located were unsurveyed, or only in part surveyed. This necessitated their proclamation by natural boundaries, which were more or less indefinite, or by description with theoretically extended township and range lines. It

* This law reads: "May reserve * * * in any part of the public lands wholly or in part covered with timber or undergrowth, whether of commercial value or not, as public reservations." * * * In the act of June 4, 1897, providing for administration, etc., of the reserves, it is declared: "No public forest reservation shall be established except to improve and protect the forest within the reservation, or for the purpose of securing favorable conditions of water flow, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States." Timber may be appraised and sold from forest reservations when "compatible with the utilization of the forests thereon."

was not for one moment supposed by those who drew these descriptions that they were to be permanent. They were merely the best that could be done to define the area to be reserved for forest purposes. Because of a failure to appreciate this, the reservation system has been as bitterly attacked on the score of including improper lands as upon any other. With an extension of our knowledge by means of accurate topographical surveys of the regions reserved and to be reserved, we shall in time arrive at a proper delimitation of the reservations. These reservations should in general be made in accordance with the topography of the country, conforming to the mountain ranges or drainage areas rather than to the arbitrary township, range, and section lines of the public-land surveys. When their boundaries are finally determined, they should be marked with monuments of the most durable character. Only when this is done is it possible to prevent unauthorized stock grazing, timber cutting, and other despoliations within the reserves.

The extension of the reserves may be expected by means of presidential proclamations, and it is my hope that we shall ultimately obtain the passage of a law reserving from all disposition public lands more valuable for timber growth and forest uses, including water conservation, than for agricultural, mineral, or other purposes, and that such lands shall be administered under a sound, economic forest policy. This was the proposition originally advanced by the American Forestry Association in a bill drawn by its executive committee as far back as 1887 and repeatedly urged upon different Congresses. This could be accomplished in a very simple way. Require every would-be entryman of the public lands to file a non-timber affidavit—that is, an affidavit which should set forth that the lands which he desires to enter are not valuable for timber, for es purposes, or the conservation of water because of the wood growth. Thus we should set aside by a gradual process of exclusion all the lands of the United States valuable in any way for forest purposes.

Of course, if the entryman made a false affidavit his entry would be subject to cancellation at any time prior to the issuance of the patent.

I have called attention to the necessity for accurate surveys of the exterior boundaries of the forest reservations. Such topographic interior surveys are equally necessary in order that the officers charged with their care and administration may know the points at which to construct fire lines, utilizing all natural advantages in the best way. Road building, and trail cutting, too, are fundamental in any permanent development of great forest properties. Only by means of the roads and trails may fires be promptly extinguished and held in check and the products of the forests economically marketed. The importance of this work in any successful management of the national forest reserves can not be overestimated, and until rapid communication over a network of trails on each reserve is possible we must not blame the forest administration for fires. The methods of fire protection inaugurated on the reservations, and the reforestation, whether by natural reproduction, by intelligent cutting, or by planting, will instruct private owners in the regions where these reservations are located.

Along the lines of forest reproduction on the reservations, at first somewhat rudely carried out because of the cost, we shall see in the future great development in forestry proper, which will increase when there is a market for the product. At present many of these reservations are too remote to get the timber to market. For many years to come, the best policy for the government in disposing of the timber product of its reservations now appears to be by sales of this product at auction to the highest bidder of such portions of the timber as may be cut without injury, or to the benefit of the reservation. In connection with the sale of timber from government reservations a system of sales must be maintained for the purpose of supplying settlers and local lumbermen. Whether this shall be by means of a system of licenses author-

izing settlers to cut under careful supervision of forest officers at a nominal charge, or by a sale of superfluous wood supplies by the forest officers, must depend largely on local conditions. Many of these suggestions are now contemplated by the regulations of the General Land Office in its administration of forest reservations.

In one respect I feel that the existing laws and regulations concerning the forest reservations should be modified. I refer to the so-called lieu selections. The law provides that persons having entries within forest reservations at the date of the proclamation may exchange their lands within such reservation for a like amount of land outside the reservation anywhere upon the public domain. The purpose of this provision was to induce all persons having a right to reside within the reservation boundaries to remove therefrom. It is my belief that a certain number of *bona fide* residents within the reservation is a good thing, for in cases of emergency such persons can be called upon to assist in the extinguishing of fires or the driving out of herders illegally grazing their stock within the reservation. These residents would naturally be most alert to prevent the extension of any fires liable to injure their own holdings, and would be likely to know of any timber cutting or herding that was going on in their vicinity. By making them forest guards they could be of great assistance in protecting the reservation and useful in other forest operations.

In another most important respect our laws must be changed before we can get the best results from the forest reservations. At present the forest work of the federal government is divided among three different bureaus—the General Land Office, the Geological Survey (both in the Interior Department), and the Bureau of Forestry in the Agricultural Department. This division can not be defended, but is natural enough when historically considered. The General Land Office was organized to *dispose* of the public domain, at first as an asset of the government, and later as a means of strengthening that government by building up new commonwealths to join the sisterhood of states.

When the idea of permanently reserving portions of the public domain for forest and water uses became a reality, a new duty was imposed upon the Land Office—that is, to *administer* perpetually a portion of the public domain, not to dispose of it. Thus we see it is foreign to the previous functions of the General Land Office to perform such administrative work.

While the Land Office has its own surveying system, it provides only for sectionizing the country—that is, dividing it into squares. This is not the kind of survey needed for forest reservations, as previously pointed out, and so the Geological Survey is called upon to make the boundary surveys of the reservations, and incidentally furnish as much topographic information concerning the reserves as is possible. Hence the second division of forest work.

The real scientific forest work of the federal government is done by the Bureau of Forestry, organized primarily to investigate forest conditions, conduct experiments as to tree growth, furnish information, and make working plans. It has no general powers of administration over forest lands from the Congress of the United States, only such as are given it voluntarily by states, corporations, and individuals. In other words, the subject-matter with which it has to deal is withheld from it under existing laws. This association has repeatedly advocated uniting all this forest work into one bureau, confidently believing that it would result in a saving of money and in far better forest management of this great national resource, which should in time become a source of annual income instead of expense. For this we are now working, and must continue to work until it is done, and then we shall see our forest reservations properly managed.

With the growing interest in national management of forest resources the demand for trained men to handle private forest properties will steadily increase, and naturally those who have had practical training on the government reserves will have the preference over others, as these reserves come to be managed more and more in accordance with sound forestry. The reserves will

thus become the best sort of forest schools, not merely for the scientific foresters, but for the much larger number of men needed as rangers and forest guards. At present the demand for such men far exceeds the supply, and many large owners of forest properties in the East have been discouraged in their intention to introduce forest management on their properties by their inability to get competent men.

I have indicated some of the lines of the future development of the federal forest reserves ; but the most important

of all will be their educational value, not only to the people and the states where they are located, but to the whole country. These reservations, scattered through a wide range of latitude and longitude and dealing with widely variant climatic conditions, must, as the years go by, furnish steadily accumulating experience of value throughout the country, and such knowledge of forestry as will put the United States in the vanguard of those nations that make the wisest use of this fundamental national resource.

STANDARD DEVICES FOR PUMPING.

BY

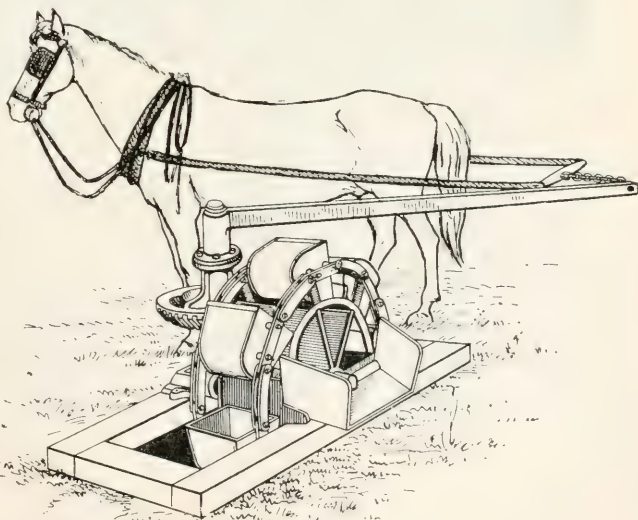
C. A. WENTWORTH.

BY far the greater portion of the water used in irrigation processes is diverted by gravity from flowing streams. Advantage is taken of the fact that $2\frac{1}{2}$ or 3 feet fall to the mile is quite sufficient to lead the water wherever it is needed, whereas the main stream from which it is taken usually falls from 4 to 8 feet in the same distance. Generally it may be said that every foot in difference of elevation which the diverted water gains over its source gives it correspondingly wider radius of utility within the same valley. After a few miles of gain the diverted water may even become available as a considerable source of power.

Under certain conditions of topography, however, it may be easier or less expensive or, indeed, the only practicable way to take advantage of a source of water supply, to pump it from a lower level to the point where it is needed.

In India and Egypt, where human labor is cheap, the natives toil patiently, operating clumsy, Oriental devices in order to gain small streams of water for their thirsty crops.

The power of cattle and horses has also been employed for pumping through the ages on various forms of machinery, which have their simplest modern examples in the capstan or the hay press and the "horse-power" treadmill.



HORSE-POWER OPERATING A BUCKET PUMP.

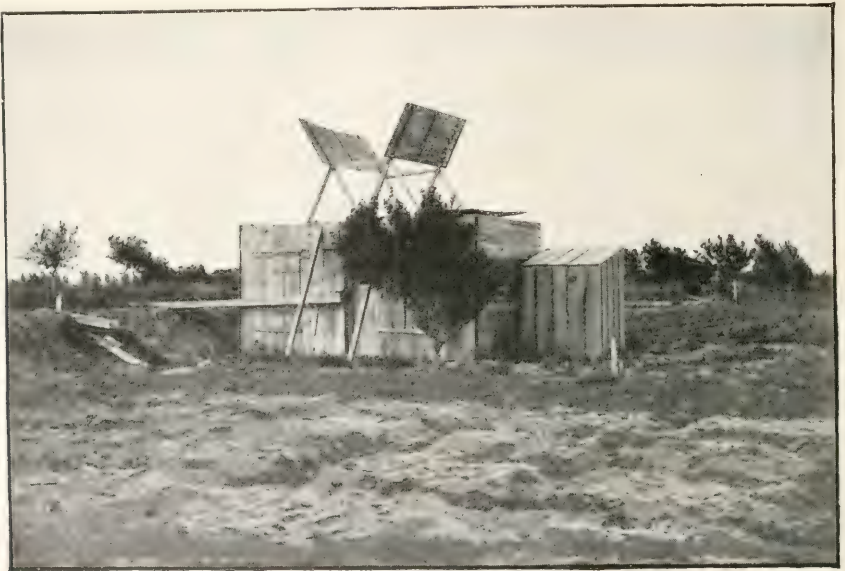
On the great plains west of the Mississippi the most available power is the force of the wind. On account of the flatness of the country the winds are almost incessant and rather more forcible than is agreeable. Fortunately, the people in these regions have been able to make a servant of the nuisance which blows the soil off their fields, and set it to make them more productive by increasing the water supply.

Various unique machines have been employed to take advantage of the measureless power afforded by the winds. Among the more ingenious home-made

use them, considering the gain in efficiency.

Mounted on scientifically braced steel towers, they catch every breath of air, face the wind automatically, and shut themselves off when their work is done. If the wind rises to violence which makes the exposure of much surface dangerous, they present only the edge of the wheel to the increasing pressure.

In much of the great plains country there is just enough rainfall to render a crop dubious. The cattle industry does not demand nearly as much water as does farming. Hence it follows that



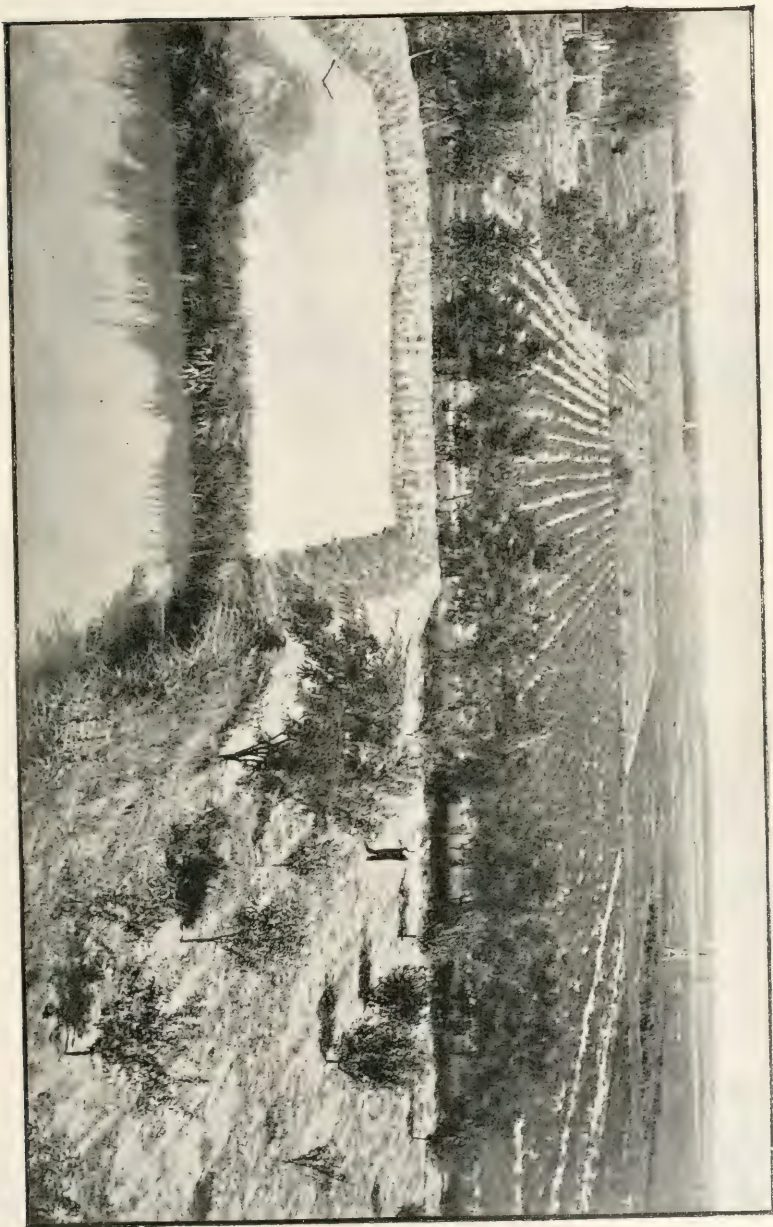
AN OVERSHOT WINDMILL.

affairs is the wind engine, which is like an old-fashioned over-shot water-wheel in construction and action. The lower half is shielded by a simple screen of boards surrounding it on all sides, so that the wind can act only on the upper half.

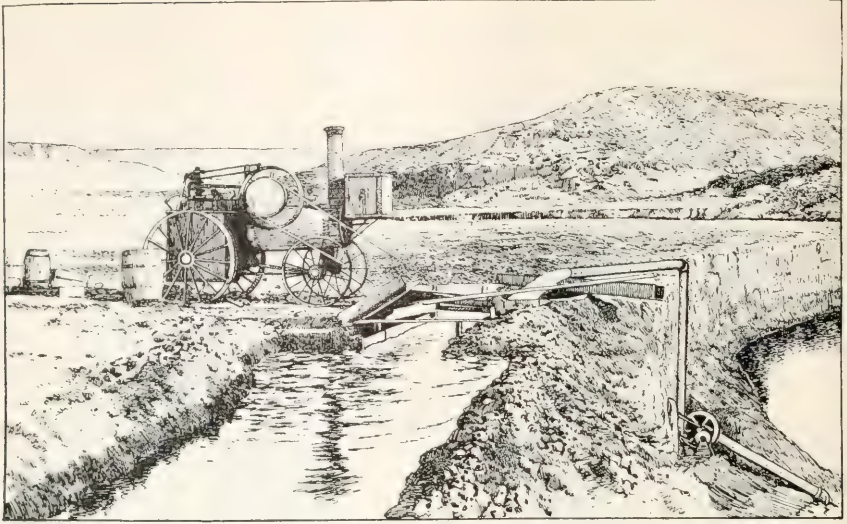
Wooden mills on wooden towers have also had their day, as well as wind wheels without towers, and wheels made with sails of cloth. The modern facility of metal construction and exact engineering calculation have produced stiff, light-running windmills made entirely of steel at a price so low that no one who needs them can afford not to

a few efficient mills can supply from the widely extended artesian basins the comparatively small extra amount of water necessary to insure successful operations in a country where there are no streams available.

But the wind sometimes proves a poor reliance. Some hot August, when cattle and crops alike are parching with thirst, a dead calm occurs, and the broad fans of the mills are motionless and useless for several days at a time. Then it is that the foresighted husbandman runs out the traction engine or gasoline engine, previously adapted and adjusted for such emergencies, and



WITHOUT THE WINDMILLS THIS SCENE WOULD BE A DESERT VIEW.



PUMPING WITH A THRESHING ENGINE.

saves his property, either by running one of his driven wells, disconnected from the windmill, or perhaps pumps water up from some stream to irrigate his fields, as shown in the accompanying cut of a California pumping outfit in operation.

In regions where streams are more numerous it is frequently of great value to the farmer or the owner of a country residence to force water up from a brook into his house and barn. The hydraulic ram is then employed—an old, well-known device, by means of which the momentum of water flowing through a long sloping pipe is employed to force a small part of the same water up to almost any ordinary and reasonable height.

Only the other day we saw a description of the apparatus employed by a

dairy farmer ten miles from Washington, D. C., who wished to force water 300 or 400 yards uphill into a 30,000-gallon tank. He tried rams. They did not supply enough water. He tried a gasoline engine. It was expensive, needed watching, and sometimes went on a strike. He tried a windmill, which proved most unsatisfactory when most needed. Finally he dammed a tiny stream, led the water a hundred yards in a trough, and allowed it to fall on a 12-foot overshot water-wheel. A triple-cylinder pump was run from the axle by a chain and sprocket. The result was perfectly satisfactory.

The pump forces 7,200 gallons daily into the tank, which is over a quarter of a mile away and at a considerable elevation from the spring which is the source of supply.



FORESTRY AND IRRIGATION IN CONGRESS

A RÉSUMÉ OF LEGISLATIVE ACTION IN REGARD TO CONSERVATION OF OUR WOODS, WATERS, AND PUBLIC LANDS BY THE FIFTY-EIGHTH CONGRESS, SECOND SESSION.

January 25, 1904.

In the Senate: Mr. Bard, from the Committee on Public Lands, to whom was referred the bill (S. 904), granting to the State of California 5 per cent of the net proceeds of the cash sales of public lands in said state, reported it without amendment, and submitted a report thereon.

The bill (S. 887) for the purchase of a national forest reserve in the Southern Appalachian Mountains, to be known as the National Appalachian Forest Reserve, was announced as first in order, but on request of Mr. Lodge and Mr. Teller was passed over.

The same bill was first in order at one time on January 27, but at the request of Mr. Teller (through Mr. Cockrell) was again passed over, without losing its place.

The bill (S. 1490), to authorize the sale of a part of what is known as the Red Lake Indian Reservation, in the State of Minnesota, was considered as in Committee of the Whole. It authorizes the Secretary of the Interior to sell, subject to the homestead laws of the United States, to the highest bidder, at public auction, in tracts not to exceed 160 acres to each individual, all that part in the State of Minnesota lying westerly of the range line between ranges 38 and 39 west of the fifth principal meridian, approximating 256,000 acres. It is provided that the land shall not be sold for less than \$4 per acre.

The bill was reported without amendment and passed.

In the House: Mr. Needham, from the Committee on the Public Lands, to which was referred the bill of the House (H. R. 3581) providing the means of acquiring title to two groves of *Sequoia gigantea* in the State of California, with a view to making national parks thereof, reported the same, with amendment, accompanied by a report (No.

461); which said bill and report were referred to the Committee of the Whole House on the state of the Union.

January 26.

In the House: Mr. Heyburn called up from the table and discussed Senate joint resolution No. 30, directing the stay of all proceedings now pending upon any application to enter or patent even-numbered sections of the public lands in lieu of odd-numbered sections surrendered by the railroad company or its assigns within the limits of any forest reserve. The resolution was finally referred to the Committee on Public Lands.

Senate bill 490, to authorize the sale of a part of what is known as the Red Lake Indian Reservation, in the State of Minnesota, was referred to the Committee on Indian Affairs.

A similar bill (H. R. 11130), by Mr. Steenerson, was referred to the Committee on Indian Affairs.

By Mr. Bede: A bill (H. R. 1136) to provide for the hearing and determination of contests of the claims of states to swamp land under swamp-land grants. To the Committee on Public Lands.

A resolution of the Salida (Colorado) Board of Trade was laid on the Speaker's desk, protesting against changes in the present land laws.

January 27.

In the Senate: Mr. Bard, from the Committee on Public Lands, to whom was referred the bill (S. 2223) providing a means of acquiring title to two groves of *Sequoia gigantea*, in the State of California, with a view to making national parks thereof, reported it with an amendment and submitted a report thereon.

Mr. Gamble, from the Committee on Public Lands, to whom was referred the bill (S. 579) to regulate the use by the public of reservoir sites located upon the

public lands of the United States, reported it without amendment and submitted a report thereon.

The bill (S. 122) authorizing the Secretary of the Interior, at his discretion, to restore to public entry lands embraced in whole or in part within segregations for reservoirs, was reported without amendment and passed.

In the House: Mr. Volstead, from the Committee on the Public Lands, to which was referred the bill of the Senate (S. 1558) to grant to the State of Minnesota certain vacant lands in said state for forestry puposes, reported the same without amendment, accompanied by a report (No. 605), both of which were referred to the Committee of the Whole House on the state of the Union.

By Mr. Powers of Massachusetts: A bill (H. R. 11209) to repeal the act providing for the sale of timber and stone lands, the desert-land act, and the commutation provision of the homestead act. To the Committee on the Public Lands.

January 28.

In the Senate: Mr. Stewart, from the Committee on Indian Affairs, to whom was referred the bill (S. 2860) to further amend an act to amend an act approved January 21, 1903, entitled "An act to amend an act entitled 'An act to provide for the use of timber and stone for industrial purposes in the Indian Territory,' approved June 6, 1900," reported it with amendments and submitted a report thereon.

February 1.

In the House, by Mr. Norris: A bill (H. R. 11520) providing for an additional homestead entry under certain conditions.

February 3.

In the House, by Mr. Dixon: A bill (H. R. 11673) for the survey and allotment of lands now embraced within the limits of the Flathead Indian Reservation in the State of Montana, and the sale and disposal of all surplus lands after allotment.

February 4.

In the House: Mr. Wadsworth, from the Committee on Agriculture, reported

a bill (H. R. 11825) making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1905, which was read a first and second time, and, with the accompanying report, referred to the Committee of the Whole House on the state of the Union and ordered to be printed.

February 5.

In the Senate; Mr. Perkins introduced a bill (S. 4134) granting to the city and county of San Francisco for water-supply purposes the use of certain lands in a forest reservation in the State of California. Referred to the Committee on Public Lands.

In the House: The House resolved itself into the Committee of the Whole House on the state of the Union. Mr. Wadsworth brought up for discussion the bill (H. R. 11825) making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1905. The bill was passed. The section relating to the Bureau of Forestry reads as follows, as amended:

"General expenses, Bureau of Forestry: To enable the Secretary of Agriculture to experiment and to make and continue investigations and report on forestry, forest reserves, forest fires, and lumbering; to advise the owners of woodlands as to the proper care of the same; to investigate and test American timber and timber trees; to seek through investigations and the planting of native and foreign species, suitable trees for the treeless regions, including the erection of the necessary buildings, provided that the cost of any building erected shall not exceed \$500; to collect and distribute valuable economic forest tree-seeds and plants; for the employment of local and special agents, clerks, assistants, and other labor required in practical forestry, and in conducting experiments and investigations in the city of Washington and elsewhere, and for collating, digesting, reporting, illustrating, and printing the results of such experiments and investigations; for the purchase of all necessary supplies, apparatus and office fixtures; for freight, and express charges and traveling and other necessary expenses, \$363,000, of which sum not to exceed \$15,500 may

be used for rent. And the employés of the Bureau of Forestry, outside of the city of Washington, may, in the discretion of the Secretary of Agriculture, without additional expense to the Government, be granted leave of absence not to exceed 15 days in any one year."

February 8.

In the Senate: Mr. Warren presented petitions of the National Live Stock Association, praying:

(1) For the enactment of legislation providing for the transfer of the administration of the forest reserves to the Department of Agriculture.

(2) Praying for an appropriation to carry forward the investigation of poisonous plants upon the ranges and the remedies or antidotes for such poisons.

(3) Praying that the Special Land Commission be given time and opportunity to study the varied conditions of different localities, that the people of each locality be given opportunity to be heard, and that no hasty action be taken upon the commission's report until the people have had time to consider any plan recommended, and, finally, that if any portion of the public ranges is placed under government control, the administration of such may be through the Department of Agriculture.

(4) Praying for investigation of the "lieu-land laws" and such modifications of the same as will prevent abuses.

Mr. Proctor (for Mr. Dillingham) introduced a bill (S. 4166) to repeal "An act for the protection of game in Alaska, and for other purposes," approved June 7, 1902, and to protect deer, moose, and caribou in Alaska. Referred to the Committee on Territories.

Mr. Perkins introduced a bill (S. 4193) providing for the appropriation of water from the Colorado River for irrigation purposes; which was referred to the Committee on Irrigation and Reclamation of Arid Lands.

February 10.

In the House: The following papers were laid upon the Clerk's desk:

Petitions from the National Board of Trade of Cleveland, Ohio, favoring the

passage of bill (H. R. 8460), providing for the transfer of forest reserves to the Department of Agriculture.

Resolutions of the National Board of Trade urging repeal of the timber and stone act, the desert-land act, and the commutation clause of the homestead act.

February 11.

In the House: Petitions of the National Board of Trade urging the repeal of the desert-land act were laid upon the Clerk's desk by three members.

February 12.

In the Senate: A message from the House announced that, among others, it had passed with amendment the bill (S. 1490) to authorize the sale of a part of what is known as the Red Lake Reservation in the State of Minnesota, in which amendment the concurrence of the Senate was requested. The Senate concurred in the amendment and the bill was passed.

February 17.

In the House, by Mr. McLachlen: A bill (H. R. 12510) providing for the rights of way in and through public lands, reservations, and certain national parks. Referred to the Committee on Public Lands.

February 18.

In the House: A message from the Senate announced that, among others, Senate bill 579, "An act to regulate the use by the public of reservoir sites located upon the public lands of the United States," had been passed, in which action the concurrence of the House was requested.

Mr. Fitzgerald laid on the Clerk's desk a resolution of the National Board of Trade favoring the transfer of forest reserves from the Department of the Interior to the Department of Agriculture.

Mr. Hill, of Connecticut, and Mr. Lilley also presented petitions from various sources favoring a forest reserve in the White Mountains and the protection of the Calaveras Big Trees.

February 19.

In the House: Mr. Lamar, of Mis-

souri, secured consideration of the bill (H. R. 8435) providing that all proofs, affidavits, and oaths required under the homestead, preëmption, timber-culture, desert-land, and timber and stone acts need no longer necessarily be made in the district where the land lies, as formerly required, but may be made in another district, provided the place where they are taken is within the same county or parish as the lands in question, and that affidavit is made, satisfactory to the Commissioner of the General Land Office, that they were taken before the nearest or the most accessible qualified officer. The bill was passed.

February 20.

In the Senate: A message from the House announced that the Speaker had signed (among others) the bill (S. 1490) to authorize the sale of a part of what is known as the Red Lake Indian Reservation, in the State of Minnesota.

Mr. Hansbrough introduced a bill (S. 4429) relating to the creation of forest reservations on the public domain, and for other purposes.

February 20.

In the Senate: Mr. Hansbrough introduced a bill (S. 4429) relating to the creation of forest reservations on the public domain.

February 23.

A message from the President of the United States announced to the Senate that the President had on the 20th instant approved and signed the act (S. 1490) to authorize the sale of a part of the Red Lake Indian Reservation in the State of Minnesota.

February 24.

In the Senate: Mr. Burnham presented a petition of the American Paper and Pulp Association praying for the establishment of a national forest reserve in the White Mountains.

During consideration of the agricultural appropriation bill (H. R. 11825) amendments by the Committee on Agriculture and Forestry were agreed to which increase the total appropriation for the Bureau of Forestry to \$450,000.

February 26.

In the House: A message from the Senate announced that the Senate had passed, with amendments, the bill (H. R. 11825) making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1905, in which the concurrence of the House of Representatives was requested.

Mr. Mondell introduced a bill (H. R. 13095) to regulate the use of forest reserve timber.

RECENT PUBLICATIONS.

The Botanical Gazette. February, 1904. Vol. XXXVII, No. 2. The University of Chicago Press. Contains an article by E. B. COPELAND and F. A. SHRINER, called "Deforestation and Creek Flow About Monroe, Wis."

The accompanying map shows as nearly as possible the changes in the surface flow of water which have accompanied the gradual removal of the native forest from four townships of Green county, Wis.

The original forest covered 83 per cent of the entire area. Twenty years ago the woodland had shrunk to 28 per cent. As mapped for September, 1902, it does not cover more than 6 per cent of the space which the primitive forest occupied.

"Until 1887 no creeks went dry, although there was a noticeable lowering. Since then the streams that are dry during the entire summers or longer amount to 65½ miles in length.

"Once twelve mills ran by water power within this area. Several now use steam and the rest have been discontinued. Where most of these mills stood less water runs now than used to be wasted."

The Agricultural Gazette of New South Wales. Vol. XIV, Part 12. December, 1903.

This is one of the most attractive and meaty agricultural papers that come to this table. As a result of recent droughts in New South Wales, the attention of farmers in that state is particularly turned to irrigation at this time. In this number Mr. W. J. Allen, who gained familiarity with irrigation problems during ten years of former residence at Riverside, California, contributes an article showing the success of various crops which obtained water during the drought from artesian wells. He also gives practical information for the proper methods of controlling and applying water to lucerne, hay crops, trees, and vines.

The Hawaiian Planters Monthly. January, 1904. Supplement, The Hawaiian Forester and Agriculturist.

The supplement is really a distinct magazine, the official organ of the Hawaiian Board of Agriculture and Forestry. Mr. William L. Hall's "Hawaiian Forests," which appeared as a leading article in the December number of **FORESTRY AND IRRIGATION**, is reprinted entire. We welcome the newcomer in the field of journalistic forestry. Such a publication should do useful work in the field opened by the increasing interest in forestry now evident in Hawaii.

Journal of Proceedings of the National Grange Patrons of Husbandry. Thirty-seventh Annual Session. Rochester, N. Y., 1903.

Three pages of this journal are devoted to discussion of the past workings of our defective land laws, with frequent reference to the report of Hon. Paris Gibson on a bill to repeal them.

The grange adopted and heartily endorsed the summary of the Gibson report, which recommended that the only title to homestead land should be obtained by five years' actual residence and continuous cultivation.

PUBLICATIONS RECEIVED.

Bulletin de la Société Centrale Forestière de Belgique. 1^{re} livraison, Janvier, 1904. Bruxelles: Imprimerie F. Vanbuggenhoudt.

Schweizerische Zeitschrift für Forstwesen. Organ des Schweizerischen Forstvereins. Redigiert von Dr. F. Frankhauser. Verlag von R. Francke. Bern, 1904.

Allgemeine Forst-und Jagd-Zeitung. 1904, Januar. Frankfurt am Main.

U. S. Department of Agriculture. Farmers' Bulletin No 187. Drainage of Farm Lands. By C. G. Elliott. Washington: Government Printing Office, 1904. An excellent practical treatise which should be read by every farmer who has occasion to drain, and certainly by every irrigator.

U. S. Department of Agriculture, Farmers' Bulletin 185. Beautifying the Home Grounds. By L. C. Corbett. Washington: Government Printing Office, 1904.

Simple landscape gardening for the owners of rural and suburban homes.

Transactions of the Royal Scottish Arboricultural Society. Vol. XVII, Part II. Edinburgh, MCMV.

The Indian Forester. A Monthly Magazine of Forestry, Agriculture, Shikar and Travel. Allahabad. December, 1903.

Oklahoma Agricultural Experiment Station Bulletin 61. January, 1904.

Field Experiments. Sugar Beets and Mangels.

Oklahoma Agricultural Experiment Station Bulletin 60. December, 1903.

Planting Trees for Posts, Fuel and Wind-break.

U. S. Department of Agriculture, Division of Biological Survey, Circular 40. Directory of State Officials and Organizations Concerned with the Protection of Birds and Game, 1903. Issued January 30, 1904.

NEW MEMBERS OF THE AMERICAN FORESTRY ASSOCIATION.

The following-named persons have joined the American Forestry Association since our last issue:

Alexander, Gerard, Louisville, Ky.

Anderson, A. A., 80 West Fortieth street, New York City (Life).

Anderson, David, Collbran, Colo.

Arnold, Paul E., Mont Alto, Franklin county, Pa.

Baldwin, Roger S., 44 Wall street, New Haven, Conn.

Bates, Miss Mary D., Ipswich, Mass.

Benson, Edward A., 1021 Cambridge avenue, Milwaukee, Wis.

Bliss, Richard, P. O. Box 507, Newport, R. I.

Boynton, E. W., Sewanee, N. J.

Chandler, A. E., Carson, Nev.

Corbett, John W., Mountainair, N. Mex.

Davidson, H. E., 530 Atlantic avenue, Boston, Mass.

Dill, W. O., Sprigg, W. Va.

Finch, W. T., Northwood, Herkimer county, N. Y.

Fuguet, H., 260 Bullitt Building, Philadelphia, Pa.

Goodding, Leslie N., 1201 D street, Lincoln, Neb.

Hale, Mrs. Benjamin, Newburyport, Mass.

Hanson, A. E., Fredericton, N. B., Canada.

Harris, H. R., Marquette, Mich.

Henderson, T. J., Wengler, Shasta county, Cal.

Hoppin, Mrs. Francis L. O., 122 East Twenty-second street, New York City.

Hubbard, Miss Helen, Charlestown, N. H.

Hunnewell, Arthur, 87 Milk street, Boston, Mass.

Isenberg, H., Lihue, H. T.

Jones, Howell, Topeka, Kans.

Jopling, J. E., Marquette, Mich.

Kaufman, N. M., Marquette, Mich.

Kreutzner, William R., Cedaredge, Colo.

Lay, Miss Harriett M., 4015 Pine street, Philadelphia, Pa.

Lincoln, Isaac, Aberdeen, S. Dak.

McCauley, Calvin H., Jr., Williamsport, Pa.

Marshall, George E., York Village, Me.

Miles, Jonas M., Concord, Mass.

Moseley, Mrs. Fred'k S., Newburyport, Mass.

Neel, Harry C., 182 Mansfield street, New Haven, Conn.

Opie, James P., Shamokin, Pa.

Parker, Edward Ludlow, Concord, Mass.

Peck, A. S., Bureau of Forestry, Washington, D. C.

Pence, J. T., Boise, Idaho.

Perkins, Miss Ellen G., Athens, Bradford county, Pa.

Reid, Clarence L., 135 Prospect street, New Haven, Conn.

Southard, George H., 164 Montague street, Brooklyn, N. Y.

Twitchell, Lee D., Mansfield, Ohio.

Twombly, John Fogg, 34 Green street, Brookline, Mass.

von Tempski, L., Makawao, Maui, H. T.

Woods, Palmer P., Mahukona, H. T.

Wyckoff, Rev. C. S., 582 Flatbush avenue, Brooklyn, N. Y.

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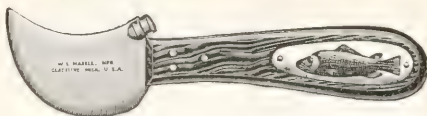
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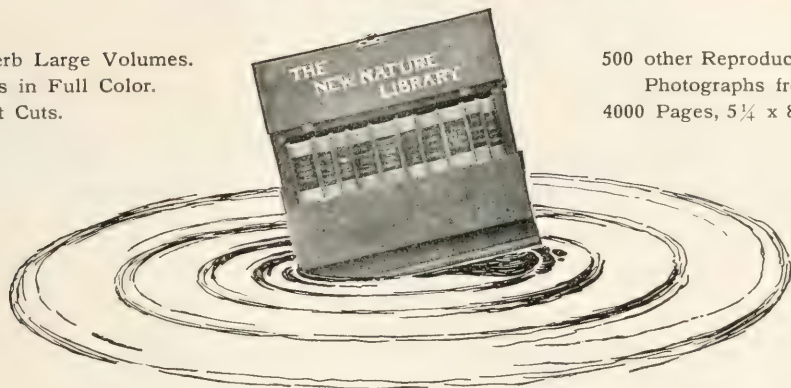
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January 9, 1904.

AARON L. TREADWELL,
Professor of Biology,
Vassar College,
Poughkeepsie, N. Y.

Says: Doubleday, Page & Co. are to be congratulated on the general excellence of the books comprised in their NATURE LIBRARY. It is the most valuable series I know for the use of the Nature lover, whether he is interested professionally or non-professionally in natural history subjects.

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HAVING succeeded to the Real Estate Department of FORESTRY AND IRRIGATION, we place our services at the disposal of all who may care to take advantage of them, either in the purchase or sale of timber or mineral lands. We have excellent facilities for conducting such business, and promise careful attention to all matters entrusted to us.

We make no charge for any services rendered unless a sale results from our efforts, at which time the compensation agreed upon when the property is placed in our hands will be expected.

We will accept under the conditions here given first-class properties and advertise them in public print and in our booklets and otherwise, absolutely without cost to our customers, except as above stated.

Descriptions of properties must be given accurately and in detail, it being understood that they must stand a thorough examination.

The property to be placed in our hands only by the owner or duly authorized agent, who has authority to make negotiations for sale.

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PROPERTIES FOR SALE

ALABAMA

A splendid opportunity for milling enterprise; 5,000 acres of choice timber lands, in solid body, located on both sides of the Black Warrior River and adjacent to railroad, near Demopolis, Ala. The timber consists of White Oak, Red Oak, Hickory, Poplar, Ash, Cypress, Gum, and Longleaf Pine, Oak predominating. Will cut 30,000,000 feet. Will sell timber under 10-year removal contract. Excellent location for saw-mill; easy and cheap transportation. Complete details on application.

HARDWOOD.—5,000 acres in Tuscaloosa county, six miles from railroad; 40,000,000 feet hardwood. **\$55,000** for timber; **\$65,000** for fee.

ARKANSAS

MANGANESE ORE LANDS.—800 acres, half mile from R. R., analyzing 50 % metallic ore. Estimated to yield 800,000 tons at cost not to exceed \$2 per ton, f. o. b. Fine investment. Particulars on application.

43,000 acres of timber land, a continuous body, located on both sides of a navigable river and convenient to 3 lines of railroads. Logging operations can be conducted all the year round at a very low cost. Labor cheap and plentiful. A large milling concern in this locality cuts and delivers logs from stump to mill for \$1.50 per thousand. The timber is estimated to cut on an average of 26,000 feet per acre; some acres will cut as high as 80,000 to 100,000 feet. The character of timber per acre, estimated, to cut as follows: Oak, 6,000 feet; Gum, 5,000 feet; Ash, 2,500 feet; Pecan, 4,000 feet; Persimmon, 3,000 feet; Hackberry, 2,000 feet; Elm, 1,000 feet; Cypress, 1,000 feet; Locust, 1,000 feet; Tupelo Gum, 1,000 feet. This tract is unexcelled of its kind in the South. Full particulars, together with price and terms, furnished on application.

SHORTLEAF PINE.—1,350 acres in Cleburne county. Timber good size and thrifty. Average cut, about 6,000 feet. Total cut, 8,000,000 feet. Price in fee, **\$11,000**.

HARDWOOD.—76,000 acres on both sides of the Ouachita River, in Union, Bradley, and Ashley counties, Arkansas, with splendid transportation facilities. It consists of hardwoods with a little Pine, and will cut an average of 6,000 feet to the acre. About 70% of this amount is White Oak, and the remaining 30% is divided between Red and Willow Oak, Pine, Cypress, and Gum. Disinterested individuals who have just returned from ranging this timber speak of it in the highest terms and say that as a milling proposition it is by all odds the best they have seen in the South. The average cut given above is based on a very careful and conservative estimate made of 69,000 acres, the balance having been made after the estimate was made. The soil is very rich and fertile and when ready for the plow will sell for more than is now asked for land and timber. **\$5.50 per acre.**

HARDWOOD.—10,000 acres in Arkansas; on railroad and also navigable river flowing into the Arkansas. Will cut 10,000 feet per acre; large percentage White Oak; balance Red, Burr, Water, Post, and Overcup Oak, Ash, Gum, and Hickory. Price, **\$5.50 per acre.**

CALIFORNIA

CALIFORNIA TIMBER

GROUP A.—5,000 acres sugar and yellow pine in Eldorado county; will cut 45,000 feet per acre. **\$20 per acre.**

GROUP B.—2,000 acres yellow pine in Eldorado county; will cut 25,000 feet per acre, and 4,000 cords of wood on tract in addition; when cleared, the best deciduous fruit lands in the state. **Only \$6 per acre.**

GROUP C.—4,640 acres of redwood in Mendocino county, on line of railroad; will cut 40,000 feet per acre; also Oregon pine, not estimated. **\$20 per acre.**

GROUP D.—22,000 acres of redwood timber in Mendocino county; more than 400,000,000 feet now standing; railway to shipping point on ocean; this proposition includes mills in operation; capacity, 100,000 feet per day; net profits alleged to be \$75,000 to \$100,000 per annum. **Bargain at \$450,000.**

GROUP E.—12,000 acres redwood on Garcia River, Mendocino county; mill site and landing on ocean; will cut 40,000 feet per acre. **Price, \$25 per acre.**

Cedar, pine, and spruce lands also for sale in unlimited quantities, particulars of which furnished on application.

FLORIDA

CYPRESS TIMBER.—Near the St. John's River, about 1,400 acres of good cypress timber; can be bought cheap for the quality; located in the midst of a forest of Longleaf Yellow Pine, also at a reasonable price. Full particulars given on application.

FLORIDA PHOSPHATE LANDS.—A magnificent bed of high-grade phosphate rock, located on the railroad in east Florida. The bed is 20 acres in extent, quantity unlimited. Government analysis shows 74.29 %. The rock comes to the surface in most places and can be mined at a small expense. A splendid opportunity for investment. Can be purchased outright or bought on royalty.

LONGLEAF PINE.—114,000 acres. Southern Railroad crosses the northern part of this tract and whole tract lies very close to Charlotte Harbor. Owner claims tract will cut not less than 2,500 feet to the acre, and titles all right. **Price, \$2.00 per acre.**

LONGLEAF PINE.—40,000 acres that will cut 5,000 feet per acre. **Price, \$6.00 per acre.**

LONGLEAF PINE.—20,000 acres in one body. Will cut 2,500 feet per acre of 8 x 8, 30 feet and upward, round timber, *i. e.*, has never been turpintined. Railroad crosses corner. If taken in one body, **price, \$3.00 per acre**

LONGLEAF PINE.—16,511 acres—average cut, 3,000 feet; 11,520 acres—average cut, 3,500 feet; 5,760 acres—average cut, 3,500 feet; all located in Liberty county, close together, on good water transportation and within easy reach of Corrabelle, Florida, where there are large sawmills. Can be handled as one proposition. Trees have not been turpintined. **Price, \$3.25 per acre for whole tract**

LONGLEAF PINE.—417,000 acres, estimated to cut 3,000 feet to the acre. **Price, \$3.00 per acre.**

LONGLEAF PINE.—140,000 acres. This is guaranteed to cut 2,500 feet per acre. **Price, \$2.50 per acre.**

LONGLEAF PINE.—53,000 acres located near Tallahassee, Florida. Will cut 3,000 feet **\$3.00 per acre.**

LONGLEAF PINE.—500,000 acres, and can add 500,000 acres more, making one million acres in one solid body of virgin Pine and Cypress. **Price, from \$2.50 to \$3.00 per acre.**

CYPRESS.—180,000 acres. Tract faces on Gulf. Will cut 2,500 feet per acre, Longleaf Pine, and in addition owner claims 100,000,000 feet of the finest Cypress in the South. **\$3.00 per acre in fee.**

KENTUCKY

95,000 acres of coal and timber land, in Pike county, Kentucky.

LOUISIANA

HARDWOOD TIMBER LAND.—175,000 acres alluvial land will be sold in parcels to suit purchaser at from \$5 to \$12 per acre. Can sell 100,000 acres in solid body. All soil is rich, and difference in price depends wholly on value of timber standing, which will cut from 3,000 to 6,000 feet per acre. To home-seekers, small tracts at \$10 per acre; \$1.50 down and balance in 3 and 5 years. Rice, sugar cane, cotton, and alfalfa are not grown to better advantage anywhere else in the state.

LONGLEAF PINE.—40,000 acres of Longleaf Pine in Southwest Louisiana. Guaranteed cut 14,000 feet per acre. **Price, \$28.00 per acre.** Satisfactory terms.

LONGLEAF PINE.—20,000 acres Longleaf Pine, southern Louisiana; on logging stream not far from railroad; another railroad surveying to build through it. This timber will cut all the way from 5,000 to 15,000 feet per acre. As a whole it will average 6,000 to 7,000 feet. Price with land, which is good soil for agricultural purposes, **\$9 per acre.**

LONGLEAF AND SHORTLEAF PINE.—100,000,000 feet with double circular sawmill, planer, two-room standard dry-kiln, good sheds, 75 or 80 tenant houses renting for from \$3 to \$10 each a month; log road seven miles long laid with 35-pound steel rails, three miles more graded and right of way cut for ten miles, and in addition 7,000 to 10,000 oak ties. Mill has a capacity of 75,000 to 80,000 feet per day. **Price, \$1.60 per thousand feet for timber, and at cost less reasonable shrinkage for mill and plant.**

LOUISIANA—Continued

SHORTLEAF PINE.—700,000,000 feet of Shortleaf Pine. The Iron Mountain R. R. is now building directly through this tract. 8,000 acres of this tract are in fee-simple, which goes with the stumpage. The owner will sell all in one lot or in lots of 150,000,000 feet. The cut will average about 7,000 feet per acre.

SHORTLEAF PINE.—12,000 acres. Will cut 7,000 feet of Shortleaf Pine per acre. Is directly on the Texas and Pacific R. R. Price, land and timber, **\$7.50 per acre.**

HARDWOOD.—6,300 acres near Washington, La., one-half mile from railroad. Will cut 8,000 feet per acre; 4,000 feet White Oak, then Red Oak, Gum, and Ash. Bordered by navigable river; soil alluvial and very rich. **Price, \$8 per acre.**

HARDWOOD.—33,000 and 17,000 acres, bordered by Tensas and Macon Rivers. The main line of the Gould system is surveyed through this land. This is one of the best timber and land propositions in the South. Will cut 8,000 feet per acre of Oak, Ash, Gum, Pecan, and Cypress. **Price, \$6 per acre.**

MISSISSIPPI

LONGLEAF YELLOW PINE.—40,000 and 8,000 acres of Longleaf Yellow Pine. This is a fine tract of pine near the N. O. and N. E. R. R. Will cut 10,000 feet per acre of Longleaf Yellow Pine. Lies in comparatively compact body. Price of the 40,000 acres, **\$24 per acre** in fee-simple; of the 8,000 acres, **\$16 per acre** in fee-simple.

LONGLEAF PINE.—25,000 acres on railroad. Guaranteed to cut 8,000 feet per acre. Also sawmill and full equipment. **Price, \$450,000.**

LONGLEAF PINE.—16,000 acres on Gulf & Ship Island Railroad. Will cut 10,000 to 12,000 feet per acre. **Price, \$26 per acre.**

LONGLEAF PINE.—22,000 acres on Gulf & Ship Island Railroad. Will cut 10,000 to 12,000 feet per acre. **Price, \$26 per acre.**

LONGLEAF PINE.—10,000 acres. Will cut 8,000 feet per acre. One-half has been turpentine. **\$9 per acre** for that which has been turpentine, **\$11 per acre** for that which has not.

HARDWOOD.—38,760 acres, lying between the Yazoo and Sunflower Rivers, both navigable and here only ten miles apart. The Yazoo & Mississippi Valley Railroad crosses one corner of the tract. This tract is claimed by timber experts to cut 7,000 feet per acre of the usual hardwoods of this locality—oak, hickory, gum, ash, etc. **Price, \$7.50 per acre.**

HARDWOOD.—6,000 acres within one mile of railroad. Estimated to cut 5,500 feet poplar, hickory, and white oak. **Price, \$9 per acre.**

HARDWOOD.—10,000 acres on new railroad. Estimated to cut 5,500 feet per acre, poplar and white oak. Land very rich, worth \$20 per acre for farming when timber is removed. **Price, \$11 per acre.**

HARDWOOD.—44,000 acres hardwood. Will cut 9,000 feet per acre, white and red oak, hickory, ash, gum, and cypress. Railroad runs through this tract. **Price, \$7.50 per acre** in fee-simple.

HARDWOOD.—100,000 acres hardwood on Yazoo & Mississippi Valley Railroad and Sunflower River. Virgin forest—oak, ash, gum, and cypress. Will cut 9,000 feet per acre. **Price, \$10 per acre.**

NORTH CAROLINA

250,000 ACRES FARMING AND TIMBER LANDS.—First and second growth estimated to cut 350,000,000 feet of pine, 500,000,000 feet of gum, 75,000,000 feet cypress. Juniper estimated to cut 2,000,000 poles. Located on the Atlantic coast. Railroad and two rivers

70,000 ACRES PINE, CYPRESS, JUNIPER, ASH, AND GUM TIMBER in Eastern North Carolina. This property is located on two sounds which empty into the Atlantic Ocean, 100 miles south of Norfolk, Va. Exceptional water transportation facilities. The longest haul to water will not exceed four miles, and would require railroad and steam skidder. The timber is estimated by a practical timber expert to cut the following amount of merchantable lumber: 85,000,000 feet of Short Leaf N. C. Pine, 100,000,000 feet of Juniper, 15,000,000 feet of Cypress, 100,000,000 feet of Black and Sweet Gum. The timber rights on the above will be sold for one dollar per thousand, with ample time to remove same, or can be purchased in fee, together with 80,000 acres additional, suitable for game preserve or farming purposes, at a very small cost. This is probably the best investment in North Carolina for the money.

HARDWOOD.—20,000 acres of hardwood in Macon county. Will cut 8,000 feet. Six miles from railroad, now being built. **Price, \$5.00 per acre.**

NORTH CAROLINA—Continued

HARDWOOD.—12,000 acres. Virgin forest of poplar, white oak, red and chestnut oak, hemlock, and some white pine. $1\frac{1}{2}$ cords tan bark per acre. This property is at present 14 miles from the railroad, but the Southern Railroad is now building a branch which will pass through this tract. Will cut from 12,000 to 15,000 feet per acre, on a conservative estimate. **Price, \$7.50 per acre.**

SOUTH CAROLINA

500,000,000 FEET OF CHOICE STANDING TIMBER.—In South Carolina, convenient to transportation both by rail and water, near tide water possessing fine harbor.

GROUP A.—Consists of 11,000 acres, estimated to cut 25,000,000 feet of cypress, as choice as grows in the South; 18,000,000 feet excellent short-leaf pine, 5,000,000 feet of cottonwood, 8,000,000 feet of oak, 3,000,000 feet of ash, balance of timber hickory, sycamore, elm, gum, etc.

GROUP B.—22,000 acres, estimated to cut 80,000,000 feet of choice cypress, 70,000,000 choice short-leaf North Carolina pine, balance of timber oak, ash, hickory, sycamore, gum, etc.

GROUP C.—14,000 acres, estimated to cut 30,000,000 feet of choice cypress, 15,000,000 of oak, 15,000,000 short-leaf pine, 8,000,000 cottonwood, 10,000,000 ash, balance hickory, sycamore, elm, gum, etc. If the above tracts are purchased outright the timber will cost less than one dollar per thousand.

TENNESSEE

COAL LAND.—3,000 acres Jellico coal land on main line of C. N. O. & T. R. R. in Kentucky, near Tennessee line. Mines are now paying net profit of \$1 per ton to owner, and will pay more. Further particulars on application.

VALUABLE SLATE QUARRY.—We have for sale a valuable property in East Tennessee, containing over 2,000 acres of excellent timber land; in addition, however, to the timber there is upon the tract a deposit of remarkably fine slate. The slate is easily and cheaply quarried—splits thin, straight and smooth, and punctures without scaling. After thorough tests the best experts have pronounced it equal to any slate in the United States. The quantity seems to be inexhaustible.

A mill has already been erected for grinding, polishing and finishing the slate, all of which is in good condition.

There is also a large storehouse, good dwelling and several cabins, besides other improvements, such as tram-roads, blacksmith shop, etc., all of which goes with the property. Immediately available is also a splendid water power of about 18 feet fall, strong enough to run a large manufacturing plant to economically handle both the slate and timber. This is reasonably accessible to railroads, and most of the year has water transportation to the Mississippi and Ohio rivers. The location of this tract gives it easiest and cheapest access to the Western market, an important factor in connection with the Western trade, which at present is supplied from more distant quarries. The reason for this property being placed on the market will be given any one interested in its possible purchase, and will be found satisfactory. We believe a bargain can be had in its purchase.

HARDWOOD.—20,000 acres hardwood, estimated to cut 8,000 feet per acre. Poplar, oak, lynn, chestnut, etc. **Price, \$9 per acre.**

TEXAS

PINE.—50,000,000 feet Pine stumpage, south Texas. Splendid location for a mill. This tract of Pine is well blocked up and is nearly in a solid body, located within 20 miles of Beaumont, on one railroad and within $2\frac{1}{2}$ miles of another.

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LIME AND CEMENT.—472 acres, containing coal, lime, and cement stone. Limestone 400 feet thick, cement rock 35 feet thick, and coal 4 to 5 feet thick. Plenty of timber on property. Plant ready for operation with modern machinery; railroad sidings on premises. For further details apply to this department.

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COAL LANDS.—10,000 acres coal lands, convenient to railroads; three veins, one $4\frac{1}{2}$ feet thick, and without slate. Cheap. Send for particulars.

WEST VIRGINIA—Continued

TIMBER INVESTMENTS.—8,000 acres spruce and hemlock, on railroad; will cut 20,000 feet per acre. **\$35 per acre.**

1,500 acres spruce and hemlock, 2 miles from railroad; will cut 25,000 feet per acre. **\$37 per acre**

54,000,000 feet fine timber, on tract of 5,500 acres on Greenbriar River and C. & O. R. R.; will cut 20,000,000 hemlock, 10,000,000 white oak, 7,000,000 red oak, 8,000,000 chestnut oak, 1,000,000 white pine, and 8,000,000 poplar, birch, chestnut, linden, hickory, locust, etc. Profits on tan bark alone will pay for the land. **\$18 per acre.**

COAL, IRON, OIL, AND TIMBER LANDS.—7,000 acres on main line Norfolk and Western. Coal developed already; timber worth \$88,000; complete prospectus furnished.

2,200 ACRES (coal and timber) **HEMLOCK, SPRUCE, CHERRY, AND ASH.** Will cut 18,000 feet per acre. One-half is Hemlock, balance principally Spruce. This tract is on the railroad and a navigable river, is magnificently timbered and underlaid with a Clarion seam of coal. The outcrop showing plainly over the property. It has not been developed as yet, the branch of the Wabash having but recently been completed. **Price, \$40 per acre.**

2,000 ACRES, containing Hemlock, Spruce, Cherry, Ash, etc. One-half of this tract will cut 20,000 feet per acre. Balance will cut 15,000 feet per acre. This is a splendid timber proposition. Is on a railroad. Good ground for stocking. **\$32 per acre.**

1,200 ACRES, containing Hemlock, Spruce, and Cherry. This tract is one mile from railroad. Will cut 18,000 feet per acre. **\$28.**

7,000 ACRES, three miles from railroad, containing Hemlock, Oak, and Poplar. This tract will cut 9,000 feet per acre, of which one-third is Hemlock. **Price, \$17 per acre.**

19,000 ACRES OF **HEMLOCK AND SPRUCE**, in Pocahontas county, W. Va., being on a navigable river and also railroad. This tract is claimed to be the finest tract of Spruce and Hemlock in W. Va., and has been estimated to cut 15,000 feet per acre of Hemlock and Spruce, besides a large quantity of Ash, Cherry, Bass Wood, and Maple, not included in this estimate. With the exception of about two thousand acres, the whole tract can be lumbered at one operation. The ground is smooth and in excellent shape to operate. **Price, \$30 per acre.**

2,500 ACRES OF **TIMBER** on both sides of a navigable river, located on two lines of railroad. Will cut 8,000 feet per acre; 3,000 feet Oak per acre. This is a good, desirable property and is accessible, as aforesaid, to two railroads, which is an item in shipping lumber. **Price, \$15 per acre.**

8,000 ACRES **SPRUCE AND HEMLOCK**, on railroad. Will cut not less than 20,000 feet per acre. It is situated in the county of Randolph and lies for several miles on the railroad and a navigable river. There is a splendid lot of bark on this tract, and it will eventually pay the purchase price of land. This is one of the very best propositions we know of in Spruce and Hemlock. **Price, \$35 per acre.**

1,500 ACRES. It is located about two miles from railroad, and except for the fact that it is not directly on the railroad the description is the same as preceding property, but if possible it is slightly better timbered. **Price, \$37 per acre.**

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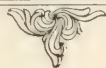
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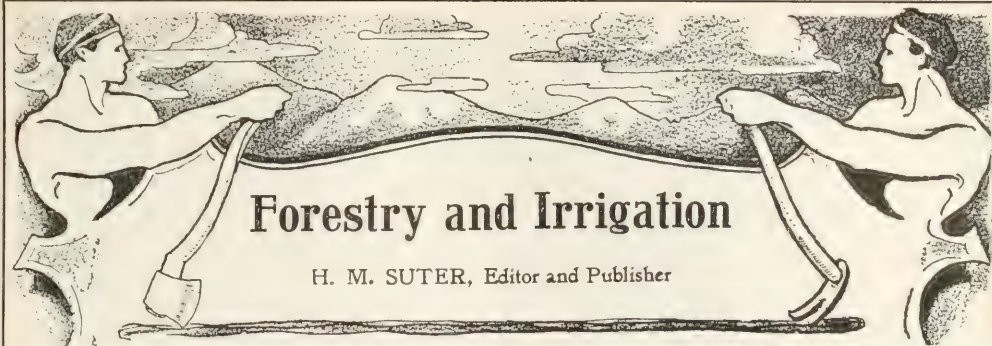
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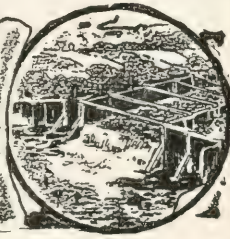
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WORK OF FIRE ABOUT RESERVOIR NO. 2 OF THE COLORADO SPRINGS WATER SYSTEM. ALTITUDE, 11,300 FEET. CAPACITY, 97 MILLION GALLONS. MOUNT GARFIELD APPEARS IN THE BACKGROUND. (SEE PAGE 169.)

Forestry and Irrigation.

VOL. X.

APRIL, 1904.

No. 4.

NEWS AND NOTES.

Prospective Legislation at Albany.

The Senate Committee on Forestry, Fish, and Game is making a sturdy fight for needed improvements in the New York State laws. After a good deal of preliminary investigation, the following measures were introduced and are now well on their way in the Legislature :

The Parks.

A bill (Senate 800) definitely settling and extending the limits of the Adirondack Park.

A bill (Senate 730) creating a forest park in the Catskill Mountain region and defining its boundaries. This, like the Adirondack Park, is to be "forever reserved and maintained for the free use of all the people."

A bill (Senate 873) amending the former law relating to forest fire protection in the following valuable points :

Concerning Fire.

The number of foresters who may be employed is no longer limited.

The Commissioner of Forests may appoint five assistant wardens, at least four of whom shall be employed during the fire season in watching the steam railroads in the Adirondack Park and inspecting locomotives.

Any fire warden may, with the approval of the Commission, establish a fire patrol during a season of drought.

Railroads in the forest preserve must remove all combustibles from the right of way at least twice a year, and additionally whenever required by the commissioner.

Locomotives must be provided with the best form of spark-arresters and the railways may be compelled to adopt any additional devices and precautions against fire which the commissioner requires in the interest of the public.

Any railroad employé is liable to \$100 fine for any violation of the fire laws occurring through his neglect, and, in addition, the company is liable to a fine of \$100 per day for each day the violation continues.

The right of the state to recover damages from fire is so extended that recovery shall be had to the distance of five miles from the place where the fire was set, notwithstanding the fire may have extended to the state lands by crossing one or more intervening tracts.

Co-operative Work.

A clause in the Annual Supply Bill appropriating \$10,000 for defining, classifying, and describing the forests in the forest preserve in conjunction with the Bureau of Forestry, provided that an equal expenditure shall be made for the purpose by the Department of Agriculture.

Lastly, a concurrent resolution of the Senate and Assembly proposes

Constitutional Amendment.

to amend the state constitution so that dead timber on burned areas may be removed so far as necessary for reforestation by officers of the state, but not by contract.

State lands outside the newly established limits of the two forest parks may be sold and the proceeds used for the purchase of lands within them.



It Might Have Been Worse. If Senator Brown can now secure the passage

of these measures he will deserve the hearty commendation of his fellow-citizens. He has probably outlined all he thought possible to gain, and in this his generalship may not be doubted, but it must be confessed that the proposed amendment to the constitution is a disappointment. We had

hoped for a repeal of the clause which prevents the state from taking care of its own property. If the amendment goes through, which is by no means certain, state forestry will still be restricted to planting. Care of living woodlands; beyond the negative work of preventing their destruction by fire, is still unprovided for. This will necessitate another amendment in the not far distant future. Why make two bites of a not unreasonably large cherry?



Forest Reserve Personals. Mr. James H. Clarke, of Denver, has been appointed Forest Superintendent of the Pike's Peak group of Forest Reserves, *vice* Mr. Henry Michelsen, deceased.

The position of Forest Superintendent in Arizona and New Mexico has been abolished, in accordance with the purpose of the Secretary of the Interior to discontinue this class of official positions as rapidly as circumstances will permit.

Forest Superintendent J. B. Hanna is transferred, to become Forest Supervisor of the Pecos River Forest Reserve in New Mexico.



Forest Reserves and "Varmints." The following communication in a recent number of *Forest and Stream* refutes a previous argument against extension of the forest reserves:

"Editor Forest and Stream:

"I have read a letter published in your last number concerning 'Wyoming Wolves and the Forest Reserve,' in which it is stated that 'there is no doubt but the reserve will become a breeding place for wolves, coyotes, and cougars, thus leading to greater friction between the reserve and the stockmen.'

"There is no reason why animals of this kind should increase in consequence of these mountains having been taken within the Yellowstone Forest Reserve.

"Since the creation of this reserve no change has been made in conditions that would tend in any way to this re-

sult. There has been no decrease in the number of settlers or diminution in the amount of stock ranged upon the reserve. The same game laws exist there as in any other portion of the state, and are most efficiently enforced by the forest rangers, who are also state game wardens. Hunters and trappers desiring to capture mountain lions, wolves, or coyotes are in no way interfered with, but, on the contrary, have every facility and opportunity for the capture of these animals upon the reserve as elsewhere. The state bounty paid on wolves applies equally to those killed on the reserve as off the reserve.

"The reserve officials recognize that mountain lions and wolves are a great menace, not only to game, but to the stock of the settlers, and the rangers, armed and constantly patrolling the reserve, are instructed to destroy at every opportunity 'varmints' of this kind. A number of wolves have already been killed by the rangers.

"A pack of dogs is now being raised for the purpose of hunting mountain lions upon the reserve.

"Many reports, without foundation, have been circulated regarding this, as well as other conditions connected with the forest reserve, with intention of stirring up opposition to the reserve. An article published in a Wyoming paper last year stated that a trapper named Lyons, going upon the reserve to hunt wolves, had been disarmed by a ranger. The department now has an affidavit, both from the ranger and from Mr. Henry Lyons, stating that the report was absolutely false.

"Thus you see a desire to create a prejudice against forest reserves on this point is entirely unwarranted.

"Settlers in our state, realizing the necessity of timber and water protection, and also realizing that the reserve was created and is being administered for their benefit, not only is all opposition disappearing, but they are rendering most valuable aid in assisting the forest officers in carrying out the rules and regulations of the Department.

"A. A. ANDERSON,
*"Special Superintendent
 "Yellowstone Forest Reserve."*

Anderson Contradicted. *Forest and Stream* for April 2 contains the following reply to the Forest Superintendent's letter:

"Editor Forest and Stream:

"In Mr. Anderson's letter such astounding statements occur that I can not let them pass unchallenged.

"He says that there is no decrease in the number of settlers by reason of the reserve. The best answer to Mr. Anderson is found in the fact that wherever one goes on the reserve are found abandoned ranches, tumble-down fences, filled up irrigation ditches, and deserted houses on which appears the notice, 'This building has been taken possession of by, and is the property of, the United States, and all persons are hereby warned against trespassing therein.'

"As to Mr. Anderson's statement, that the same amount of stock is on the reserve as formerly, I challenge him to publish the amount actually allowed on the reserve as against those kept off. Last summer tens of thousands of acres of grass went to waste, though the stock was ready to eat it, and this winter thousands of tons of hay have been sold for the cost of putting it up, or are rotting in the stacks, simply because the stock cannot be summered on the reserve. I expect to burn 200 tons of standing hay next fall that should be worth six dollars a ton; and on hundreds of acres of land I shall not even turn the water, because of Mr. Anderson's management of the reserve.

"As to the reserve becoming a breeding ground for wild animals, here are the facts: Here is a great tract of mountain country, thinly settled, and intended to be kept so. It is well stocked with game to furnish food, and every attempt is being made to have as little hunting done thereon as possible. The cougars are already there, and the wolves have found out its advantages and are coming in droves.

"With the boundaries restricted to the actual forest and mountain lands, and with a man in charge well informed as to actual conditions and who possesses the respect and confidence of the

people, much might be done. As it is, the situation is bad. A heavy blow has been struck at the development of Wyoming, and very little good accomplished. The forests could have been protected just as well with a much smaller reserve. These forests are mainly of lodgepole pine, are of very little commercial value, and were in no danger until railroads came.

"Nothing has been done toward the main object of game protection, to save the larger males, so as to provide trophies that are worth going after. Bull elk scalps are worth \$8 to \$15; bull elk tusks, \$2 to \$5 each; mountain sheep scalps \$3 to \$8; and from \$50 to \$500 for extra large elk and sheep heads. And if anyone thinks that no elk and sheep are killed at these prices, they are mistaken. For the next two months is the hunters' harvest. The big bulls and rams are weak and are bunched in sheltered places.

"I can leave home tomorrow morning and before night have a hundred dollars' worth of elk tusks in my pocket, and in a month can have a thousand dollars' worth of heads cached, ready to pack out in the spring, and no one the wiser. And I don't know but what I might just as well do it.

"WILLIAM WELLS.

"WELLS, WYOMING."



Where the Shoe Pinches. As usual, we have just enough of the facts from both sides to make one unacquainted with the situation give up the problem in despair. The following additional statements, which we have on good authority, may serve to throw some light on the subject.

Under Mr. Anderson's administration the game has been very carefully preserved. This was a necessary policy on account of the fact that the elk from the National Park drift southeastward through the reserve in search of winter feed, and right in their line of travel a number of men have taken squatter's claims, so high up in the mountains (8000 feet or more) that no sane man would have settled there for agricultural purposes.

As a result of a \$40 non-resident license law and increased vigilance of the rangers, the business of head and tusk hunters has been much interfered with; hence the "deserted houses" mentioned, which are now used by the rangers. The *bona fide* settlers of Wyoming have suffered no injury.

Why Mr. Wells should be so rash as to burn his hay is difficult to understand, since there are plenty of cattle to eat it along the upper waters of the Green River.

The reserve has saved a great deal of timber which would otherwise have floated down the Green (Colorado) River in the form of ties. The old tie-cuttings within a few miles of Mr. Wells' home are sufficient evidence of the fate that formerly awaited the forest cover of this important basin.

It is quite possible that there are points for criticism in Mr. Anderson's administration. Few men are without a flaw, and the reserve system is too new to be perfect under all circumstances; but in nine cases out of ten it seems to be the rule that the men with strenuous objections are those who are no longer allowed to do as they please with the national land and timber and water and game.

Tennessee Forest Commission. An act of the last Legislature in Tennessee directed the Governor to appoint a State Forestry Commission, consisting of three members. In pursuance to this act Governor Frazier has lately selected Prof. C. A. Keffer, of Knoxville; Col. Hugh L. Bedford, of Bartlett, and Col. J. B. Killebrew, of Nashville.

The new commission met March 18 and elected Col. Killebrew chairman and Prof. Keffer secretary.

After a full interchange of opinions, it was decided that each Commissioner should prepare a report for his section of the State, with especial reference to the present acreage and conditions of the forests; the degree to which commercial species had been exhausted, and what practical methods could be employed in reforesting worn out lands.

With these reports will be embodied the recommendations of the Commission for legislation to secure protection from fire and to encourage the reforesting of lands not useful for agricultural purposes.

"Adirondack" Murray Dead. Rev. William H. H. Murray, widely known for years as "Adirondack" Murray, died at his home in Guilford, Conn., March 3, aged 64.

He was one of the pioneers of the modern yearly invasion of the North Woods by an ever-growing army of recreation seekers, and his book, "Camp Life in the Adirondack Mountains," was the cause of much of the interest in this region, and of the soubriquet bestowed upon its author.

New Club Planned. With the advice and approval of Mr. Pinchot and others well known in the government forest and water service, a project is on foot to form a club in Washington from the field men of the Bureau of Forestry, the Reclamation Service, and possibly the Land Office and the Bureau of Soils.

There is no doubt that such an organization would be a very good thing for the men and for the service, provided the contemplated advantages can be secured for a reasonable rate of dues. There is plenty of good club material within the limits mentioned, but a large number of the men are not in a position to stand more than very moderate assessments cheerfully.

A committee consisting of Mr. J. B. Adams, Mr. Thomas Sherrard, Mr. George Woodruff, and Mr. Coert Du Bois, all of the Bureau of Forestry, are now engaged in looking up a suitable house and promise of membership sufficient to warrant the undertaking.

Canadian Forestry Association. The following papers were delivered at the fifth annual meeting of the Canadian Forestry Association, which was held in Toronto March 10 and 11: "Systems of Ad-

ministration of Timber Lands in Canada," Aubrey White, Assistant Commissioner of Crown Lands, Toronto, Ont.; "Forestry in Relation to Irrigation," J. S. Dennis, Superintendent of Irrigation of the Canadian Pacific Railway Company, Calgary, Alberta; "Forest Reproduction in Germany," Dr. A. Harold Unwin, of the Dominion Forestry Branch, Ottawa; "Forest Management," John Bertram, President Dominion Transportation Commission; "Forestry Education," John Loudon, M. A., LL. D., President Toronto University; "Some Ontario Forestry Problems," Prof. H. L. Hutt, Guelph.

A banquet was held at the King Edward Hotel on the evening of March 10, at which speeches were delivered by prominent public men.

On the invitation of E. G. Joly de Lotbinière, it was decided to make Quebec the next place of meeting.



Society of American Foresters.

At the residence of Mr. Pinchot, March 10, Dr. von Schrenck gave a most interesting discus-

sion of the work which he is directing in various parts of the United States in experimenting on the chemical treatment of inferior woods to lengthen their useful period as railway ties, poles, posts, cross-arms, and piles.

Mr. George Woodruff, Attorney of the Bureau of Forestry, spoke briefly of the various land laws which are a matter of such interest and importance as regards matters of forest and water conservation in the West.

At the usual Thursday meeting of the Society, held March 24, at the residence of the Forester, Mr. Olmstead and Mr. Allen talked briefly of forest-reserve matters.

Mr. Olmstead, confining his remarks to Arizona, urged that in this territory the utmost care should be exercised in husbanding the timber and other forest resources, and that grazing should be most carefully regulated, since a satisfactory new growth is secured only with difficulty on account of climatic conditions, and the soil is so friable that when rain does occur erosion is excessive and

irrigation reservoirs are eventually clogged with silt.

Mr. Allen, speaking of Idaho, Montana, and Colorado, said that in the northern country the greatest value of forest reserves lies, as in Arizona, in their power to conserve water and soil. There are, however, a few forested areas in which the value of the timber itself is the prime consideration, since if these were stripped, and the timber exported, the local mines could not be developed.

Nevertheless, in one section mining men are afraid to support, publicly, the fact that they desire the timber near them reserved, because the implication that the supply is exhaustible would injure their stocks.

He advanced the opinion that many of the new reserves should be held without applying many of the present reserve regulations until Congress furnishes funds sufficient to give them a ranger service adequate to enforce such regulations satisfactorily.

This opinion is based on observations that local hostility is frequently due, not to the reserves themselves, but to inefficient administration.



Reports of Fires.

Severe forest fires are reported from Georgia and South Carolina during the last two weeks of March.

In the first week Kansas and Oklahoma suffered from prairie fires which swept the remaining feed from the range, destroyed farms, threatened villages, and killed five persons. Hundreds were made destitute.



Forestry Lectures.

It is announced that Mr. Overton W. Price, Assistant Forester of the U. S. Department of Agriculture, will deliver a series of four lectures before the senior class of the Yale Forest School, covering the organization of the field-work of the Bureau of Forestry, the point of view of the Bureau toward its field-work, and an outline of the methods under which field-work is carried on.

These lectures will be given at Milford, Pennsylvania, during the last week of this month.

Thousands of New Homes. Nevada will soon have one of the largest irrigation systems in the world. Mr. L. H. Taylor, District Engineer for the United States Reclamation Service for Nevada, has recently been in Washington and reports the satisfactory progress of the Truckee-Carson reclamation project, of which he has immediate charge.

This project contemplates the utilization of the waters of the Truckee and Carson rivers for the irrigation of about 375,000 acres of sage brush desert in western Nevada. These lands will furnish homesteads of about 80 acres each for about 4,500 families. It is expected that, with the addition of the towns and villages that will naturally spring up in the district, the population of the state will be increased in the next few years by at least 60,000 people.

Active construction is now in progress on a main canal about 31 miles long, which is to divert the waters of Truckee River to a large storage reservoir on the lower Carson River. There the waters of the two streams will be mingled and impounded, and thence led out upon the plains in the vicinity of the Carson and Humboldt Sink. Two contracts for the construction of different divisions of this canal were made by the Secretary of the Interior with E. B. and A. L. Stone Company and C. A. Warren & Co., California contracting firms, on August 28 and September 3, 1903, respectively. Ground was broken on September 11, 1903, and the work is to be finished by November of the present year. In the meantime, surveys for the requisite system of distributing canals are well under way, and the department will be ready in the spring to contract for their construction. This work will be followed by the erection of a dam which will form the reservoir on the Carson River. The reservoir will have a total length of about 18 miles and will flood over 10,000 acres of land to an average depth of 28 feet.

The lands to be irrigated by these works aggregate about 300,000 acres, situated in the lower portions of the Truckee, Carson, and Humboldt River basins. In the upper valley of the

Truckee and Carson rivers some 75,000 acres of additional land will be supplied from works to be constructed some time in the future. As these great areas are gradually brought under cultivation, and a greater water supply is required, ten additional reservoirs, including Lake Tahoe, are to be added.



Tree Surgery.

Careful horticulturists treat a cavity in the trunk of an orchard tree much as a dentist treats a hollow tooth. The cavities are due to the work of fungi whose spores find lodgment in any wound in the bark, especially such injuries as the tearing out or careless pruning of a branch. The fungi attack the living tissues and rapidly enlarge the hole by the decay of surrounding portions of the wood. All the decayed wood is grubbed out as far as possible with a gouge or scraper. The clean surface within the cavity should be painted with coal tar, to kill any germ of decay that might remain, and the hole finally filled with Portland cement, tamping-in firmly and smoothly on the outside flush with the edges of the cavity. The new bark will then begin to close over the cement, and, if the tree has vigor enough, will finally completely cover it. The cement prevents water from accumulating in the cavity, which goes a long way toward preventing the lodgment and growth of the spores.

In foreign forests under careful management the trees which show injury of this nature receive the treatment mentioned or some equivalent process.

The oaks on the campus of the University of California have been treated in this way for a number of years, with very satisfactory results.



Tangled in the Foliage.

At the live-stock show recently held in Chicago Secretary of Agriculture

James Wilson was one of the speakers at a mass meeting of cattlemen. Behind him on the same platform, relates the *New York Herald*, somewhat screened from observation, sat Norman J. Col-

man, the first man to hold the portfolio of agriculture.

Secretary Wilson made a happy speech, and because of his popularity with the western ruralist he was the shining, central figure of the gathering. When he had finished talking, lusty lungs and sunburned hands gave him noisy approbation. The applause had not ceased when a Nebraska farmer, with whiskers like Senator Peffer's, arose in the back of the hall and said:

"Gentlemen, we are all mighty glad to hear Secretary Wilson and are ready to do him honor; but let us not forget the other great men we have with us. We have on the same platform to-night the Alfalfa and Omega of agriculture!"—

It was as far as the speaker ever got. His few remaining words were lost in the shrieks of laughter.



At Biltmore. Mr. P. P. Pelton, of the Biltmore Forest School, writes that Dr. Schenck has been experimenting with a method of storing acorns over winter with a view to preparing them for more rapid starting of growth when planted.

Just beneath the outtake at fish hatchery No. 1, a large wire-netting box was placed, through which the escaping water flowed constantly. In this box, when cold weather came, were placed a couple of bushels of acorns. All through the winter an unceasing stream of cold water has poured over them. The idea, of course, is the maintenance of a constant temperature and air supply.

Much trouble has been experienced in obtaining in sufficient quantities a proper covering for newly planted seed beds during the winter season. Of the several materials used, one that seems to be unusually good is old, weather-beaten burlap. It forms a good cover and is easily removed in the spring.

Another point of interest is the use of well rotted sawdust as a top dressing between rows of seedlings during the winter. The results are excellent. The sawdust keeps the temperature as even as does manure. It prevents "boosting" of the young plants by frost, and will be allowed to remain on the beds during the

summer as a protection against evaporation. It acts to some extent as a fertilizer and its cost is trifling.



Kansans' Meeting.

The State Horticultural Society of Kansas will hold a special meeting at Dodge City, Kansas, May 11 and 12, which will be devoted entirely to forestry and irrigation.

The Bureau of Forestry will be represented by Mr. William L. Hall, who will speak on "The Progress of Forestry in the United States," and Mr. R. S. Kellogg, who will discuss "Forest Planting in Western Kansas."

Mr. M. C. Hinderlider, of the U. S. Geological Survey, will talk of the work of the Reclamation Service.

The program is not yet completed, but it is announced that a number of prominent Kansans who are well informed on these matters will take part.

This meeting should be one of great interest, and it is hoped that a large attendance will carry its benefits through a wide range of influence.



To Buy Reservoir Site.

Another step has been taken toward the transformation of the arid West. The Secretary of the Interior has authorized the purchase of the Hondo reservoir site in New Mexico for the sum of \$20,000. It is in Chaves county, about 12 miles west of Roswell.

The site of this proposed reservoir is a natural depression, which, with a small amount of embankment, can be given a capacity of 40,000 acre-feet. This will hold practically all the water that the Hondo will furnish during low-water years. It is proposed to store here the flood waters of this stream and draw on them through lateral canals for irrigating the lands below the reservoir.

The lands that will be benefited by the reservoir waters are naturally fertile and may be easily irrigated at slight expense. They are free from alkali and will be ultimately worth at least \$100 an acre when planted to alfalfa

and corn. If used for fruit growing, to which they are specially adapted, they may have a far greater value.

No engineering difficulties are expected in the work. The natural reservoir will have to be enlarged and canals built for the inlet and outlet of the waters. It is estimated that the cost of constructing the reservoir and bringing the water to the arid lands will approximate \$240,000, or \$20 an acre for a minimum acreage of 12,000. It is believed, however, that nearly 15,000 acres will be served.

Destruction of Italian Cork Forests. While Spain still furnishes 32,800 tons of cork annually, the production of Italy has decreased to 4,000 tons. The value of the Spanish exports of cork amounts to \$6,000,000 per year, against less than \$250,000 for Italy. Only Sicily and Sardinia are still producing cork to any considerable extent in Italy, while the former great oak forests of Calabria are almost totally destroyed. It seems incomprehensible that this destruction has been permitted. The trees easily reach an age of two hundred years. They yield cork in their thirtieth year and continue to do so every seven years. Seventy-five years ago the English demand for cork was supplied exclusively from Italy. The destruction of the remaining forests goes on uninterruptedly, and nobody seems to try to prevent it or to plant new trees. Italy has the most favorable soil and climate possible for this industry, the volcanic soil of the peninsula being considered an important factor in the development of high-grade cork.

Water and Forest Convention. The annual meeting of the California Water and Forest Association will take place April 22 at the rooms of the Chamber of Commerce, San Francisco.

Reports are expected from the government officials who have charge of the coöperative forestry work carried on by the state and the United States.

The prospects for further accomplishment and the necessity for further appropriations will be matters for discussion.

Nebraska Planting Resumed.

Mr. C. A. Scott writes from the planting reserve at Halsey, Nebraska, March 20.

"Everything here has wintered in fine condition. We sustained a slight loss in seedling jack pine and the California species, but in general the seedlings wintered well.

"For two weeks the weather has been favorable, and we have already planted about 10 acres of sandhills, and have the ground plowed for our nursery rows. The planting is done with seed from hand corn-planters. I have three student assistants and one laborer at present."

Hydrology in California. The U. S. Geological Survey is investigating the underground water resources of the Southwest. In southwestern California, where the surface streams have been highly developed, the hope of future increase in the water supply can only be found in the underground waters. During the past year Mr. Homer Hamlin has compiled records of the wells and is making a study of the extent of the artesian basins. Extensive experiments have been carried on to determine the velocity of the underground waters by actual measurement of the rate of flow. Investigations are also being made by Mr. W. C. Mendenhall, geologist, the idea being to combine an engineering and geological study of these situations.

All the wells in the district are being located upon topographic maps, the depth of water determined, and the output and elevation of the water plain contoured upon the topographic map, which will probably be issued within a few months. Records have been compiled from over 5,000 wells. It is believed in many districts of southern California there has been an overdevelopment of these underground waters,

which, if unrestrained, will lead to the exhaustion of the supply. It is particularly desirable that the relation between the actual inflow and the actual output should be determined. Any increase in the amount of the ground waters absorbed by the diversion of the streams over gravel beds in mid-winter would be of marked benefit by increasing the water supply available from the wells in midsummer.



Big Working Plans.

Mr. Frederick Weyerhaeuser, president of the Weyerhaeuser Timber Company, has signed an agreement with the Bureau of Forestry by which the Bureau agrees to prepare working plans for the conservative management of about 1,300,000 acres of the company's timber lands in Washington.

The Northern Pacific Railway Company has also requested that the Bureau of Forestry prepare working plans for its enormous timber land holdings in Washington and Idaho.

The timber lands of the Weyerhaeuser and the Northern Pacific Companies are the most extensive privately owned tracts of land for which the Bureau of Forestry has ever been asked to prepare working plans. The field work will begin next summer. How long it will continue before figures enough are secured on which to base plans intelligently it is impossible at present to state. The task of putting all these lands under careful management is of great magnitude, and only one familiar with the nature of the forests of the Northwest can appreciate its difficulties. But great as these difficulties are, the importance and value of the work, once accomplished, far outweigh them. It is another proof of the profound interest and confidence which the West has come to feel in the practical results of forestry that the two greatest land-holding companies of the Pacific coast and Rocky Mountain States, the one representative of the lumber, the other of the railroad interests of that country, should have called on the Bureau of Forestry for expert advice in managing their lands. The main timber supply

of the United States is contained in the Northwestern States, and the great advances which forestry has made in that part of the country must be regarded everywhere as of general benefit.



The Agreement. The following is the text of the agreement under which the Bureau of Forestry is to prepare working plans for the Weyerhaeuser Company:

The Department of Agriculture of the United States and Weyerhaeuser Timber Company of St. Paul, county of Ramsey, State of Minnesota, mutually agree together as follows:

1. The Department of Agriculture, in pursuance of investigations in forestry and in order to disseminate a knowledge of improved ways of handling forest lands, shall, after personal study on the ground by its agent or agents, prepare a plan for harvesting the forest crop and reproducing the forest on the land of the said Weyerhaeuser Timber Company, situated and described as follows: 1,300,000 acres, more or less, State of Washington.

2. The said plan shall be prepared for the purpose of promoting and increasing the present value and usefulness of the said land to its owner, and to perpetuate and improve the forest upon it.

3. Upon the completion of the said plan and its acceptance by the said Weyerhaeuser Timber Company, the Department of Agriculture shall supervise the execution thereof so far as may be necessary.

4. The cost of executing the provisions of this agreement shall be paid as follows:

(a) The salaries of all the employes of the Department of Agriculture engaged in fulfilling this agreement shall be paid by the department.

(b) A preliminary visit of inspection, if required, shall be wholly at the charge of the department.

(c) Actual and necessary expenses for traveling and subsistence of the agent or agents of the department working under this agreement, except as provided in the foregoing paragraph (b),

shall be paid by the said Weyerhaeuser Timber Company. What are "actual and necessary expenses" shall be determined by the printed regulations of the department. Expenses under this paragraph (c) are estimated, for the preparation of this working plan, at five thousand (5,000) dollars.

(d) Necessary assistants shall be furnished by the said Weyerhaeuser Timber Company without cost to the department. It is estimated that — such assistants will be required for — to prepare this working plan.

(e) The department shall not participate in any degree in the receipts and expenses arising from said land, except as above provided.

5. The Department of Agriculture shall have the right to publish and distribute the said plan and its results for the information of lumbermen, forest-owners, and others whom it may concern.

6. This agreement may be dissolved by either party upon ten days' notice given to the other.



Eastern View of Irrigation. The following communication, recently published in the *New York Times*, is likely to be of interest to readers of *FORESTRY AND IRRIGATION*:
To the Editor of the New York Times:

From a recent report made by the Agricultural Department at Washington we learn that our crops of corn, wheat, oats, barley, rye, buckwheat, flaxseed, potatoes, and hay for 1903 were raised upon 215,000,000 acres of land, or 11 per cent of the area of the republic, not including Alaska. The farm value of these crops is placed at \$3,000,000,000, or at the rate of \$13.70 per acre. Wheat was valued at 62½ cents per bushel, and other crops in proportion.

Engineers who have made a study of irrigation and of our arid lands west of the Mississippi claim that 100,000,000 acres can be reclaimed by irrigation, and made highly productive lands, which command at all times and seasons an abundant supply of water, and will yield larger and more uniform crops

than land in the valley of the Mississippi dependent upon the rainfall.

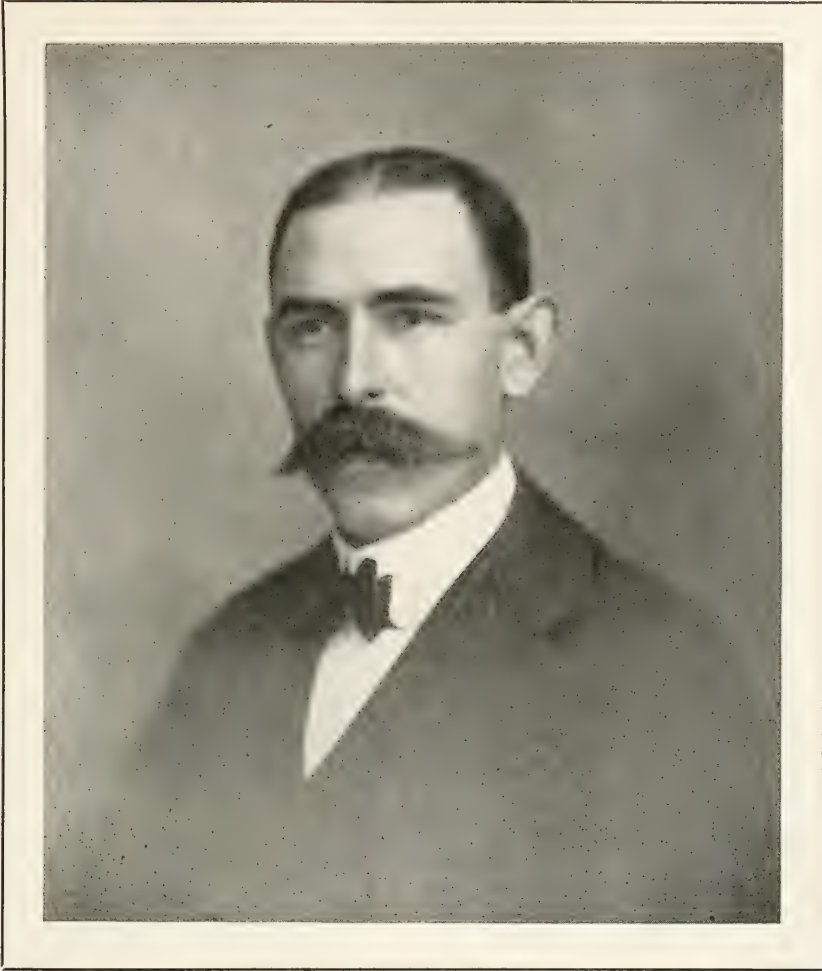
Irrigated lands in California sell for from \$100 to \$1,000 per acre, and have been sold for \$1,800. In Colorado this season 710 tons of sugar beets were produced upon 29 acres of irrigated land, and were sold to a sugar refinery for \$3,195. Irrigated lands planted with fruit trees, grapes, oranges, almonds, and small fruits often yield \$1,000 per acre. A conservative value of 100,000,000 acres of irrigated land in our trans-Mississippi and Pacific States would be \$10,000,000,000, or \$100 per acre. The annual value of the products should be not less than \$25 per acre, or a total value of \$2,500,000,000.

Ten billions added to the accumulated wealth of the nation in the form of productive land, yielding an income of \$2,500,000,000, will give stability to our investments in railways, steamships, and manufactories. The reclamation of these lands involves no entangling international problems to solve, nor should their reclamation be made a question of party politics. It is a problem for the nation to solve, and not the states or private corporations.

The Empire of Germany and the Republic of France have an area of 263,000,000 acres and a population of 93,000,000. If we assume that 40 per cent of their lands are under tillage, their crops of food products named above are raised upon 105,200,000 acres of land. They produced in 1900 400,000,000 bushels of wheat, 400,000,000 bushels of rye, and 30,000,000 tons of sugar beets and other crops for the support of 93,000,000 people.

The reclamation of our arid lands means a vast and permanent enlargement of our home market for the product of our industrial establishments. Irrigated lands will repay intensive cultivation because the returns from such lands are large and constant; that means increased employment for unskilled labor. There is no dark or doubtful side in the solution of the reclamation of our arid lands. No class will be injured. On the contrary, all classes will be benefited.

FRANCIS WAYLAND GLEN.



MR. JOSEPH BARLOW LIPPINCOTT,

ONE OF THE LEADING ENGINEERS OF THE UNITED STATES RECLAMATION SERVICE.

JOSEPH BARLOW LIPPINCOTT, as a supervising engineer in the Reclamation Service, in charge of its California work, occupies a position of extreme importance. In addition to decided ability as an engineer and wide experience in his calling, Mr. Lippincott has an intimate knowledge of the water resources of the State of California. He was born at Scranton, Pennsylvania, October 10, 1864, and educated at Dickinson College, Pennsylvania, and the University of Kansas, receiving the degree of B. S. in 1886. Since that time he has been continuously engaged in civil engineering. In July, 1888, he was employed by the U. S. Geological Survey for topographic work, and continued until 1892, when he was appointed assistant engineer for the Bear Valley Irrigation Company, of Redlands, California, and assisted in building a portion of the Santa Ana Canal. In 1893 he took charge of the field work of an enterprise contemplating the irrigation of 30,000 acres in the northwestern portion of Los Angeles County, California. This work was abandoned in December, 1894. In January, 1895, he was placed in charge of the hydrographic investigations for the U. S. Geological Survey in California, and has had charge of this work to date. Mr. Lippincott, in addition to his field work, is also the author of various U. S. Geological Survey publications. He has been employed on domestic waterworks of various cities, including San Francisco, Los Angeles, and Santa Barbara, California, as consulting engineer, and also in the same capacity by a number of irrigation companies. Mr. Lippincott has reached his present high position at an early age, and the people are thus assured of his services in this great work for some time to come.

THE PHILIPPINE FORESTRY SERVICE.

SOME NOTES ON THE LIFE AND WORK OF
AMERICAN FORESTERS IN THE FAR EAST.

BY

W. KLEMME, FORESTER.

THE personnel of the Forestry Bureau has been decidedly augmented during the past two years, and at present numbers over two hundred men, who receive an annual remuneration of about \$219,000, Philippine currency.

Of the employees in the provinces, the greater number are Filipinos. The whole force possesses but six educated foresters, and the need of Americans, as well as natives, who have a practical knowledge of this profession is at all times pressing. It is not meant by this a superficial preparation, nor even a personal attraction for the life, but one based upon serious application and practical knowledge of sound methods.

As regards remuneration, foresters receive, on appointment, \$100 (gold) per month, subject to gradual increase, on proof of efficiency, to \$200 (gold) per month. Since they spend the major part of the time in the field, where the bulk of expense is borne by the Bureau, they are enabled to save money, providing, of course, that the necessary disposition to do so exists. In the city of Manila prices are exorbitant, but one can live there quite comfortably for \$100 (gold) a month.

The intention of remaining in the service several years should exist. Conditions in the archipelago are so different from those in more temperate climes that even a forester with valuable experience has much to learn, and it goes without saying that his resignation at a time when his services have become valuable to the Bureau cannot meet its approbation.

CLIMATIC CONDITIONS.

The life of a forester in these islands is one of infinite variety, much educational experience, and large possibili-

ties. The hardships and inconveniences are those incident to exposure to the elements and life in an undeveloped country. Among them may be mentioned isolation, infrequency of mail service, and the number of the dialects spoken by the natives, for each province has its own language.

During the rainy season, which extends from June to November, there is a steady and at times disheartening down-



HAGACHAC TREE, 115 FEET IN CLEAR LENGTH.*

*Hagadhad (*Dipterocarpus* sp.)?

pour. Frequently the forester sits in his tent or nipa hut while rain is percolating through all surrounding objects—papers, instruments, provisions, and blankets. Under such conditions patience has heavy drafts falling due and good humor flies to a premium. Patience is especially necessary, as the natives, like all inhabitants of tropical countries, are slow and adverse to work as long as they have plenty of rice and a few fish; but if one considers their peculiarities, he can get along with them very well. No trouble has been encountered by the writer during the two years' work in the provinces.

In the field the mean temperature is pleasant. It seldom becomes oppressively warm and never cold. The nights are always refreshingly cool. Woolen blankets are necessary, and often during the winter months two of them can be used and a rain coat added with comfort.

CALIPERING.

Each forester is in charge of a district, usually one province. As the number of men engaged at present in this work is not sufficient to cover the Archipelago,

districts have been selected where timber cutting is most in progress. The main duty of the forester is inspecting the work in the woods and marking timber for felling, but, in addition, he has control of the native rangers. A report of daily operations is, however, sent direct to the main office.

The marking of trees is necessarily a slow and tedious process, and it is hoped that before long rangers will be able to do the greater part of it. This would permit the forester to assume control over a wider range and confine personal work to inspection and supervision, permitting him to get thoroughly acquainted with the district under his charge, to cover it with valuation surveys and reproduction studies, and extend the knowledge of the different tree species. In this regard it may be interesting to note that at present the Bureau shows a classified list of 665 species indigenous to the soil, including approximately the most valuable woods of economic or commercial value. It is expected that eventually from 1,000 to 1,500 species will be secured.

In marking trees many things are to



NATIVE METHOD OF SKIDDING WITH CARIBAO IN LUZON. A CHANCE FOR AMERICAN IMPROVEMENT.



SCALING RAFTED TIMBER NEAR MANILA. NOTE BAMBOO WITHES WHICH BIND THE LOGS.

be considered. If the rules of silviculture are followed, it is comparatively easy; but often, when a tree is found that should be felled, the licensee or his representative steps in and demurs. It is too large to be hauled out of the forest, too far from water, or a useless species, they say. To illustrate: Although there are in the writer's district over 250 species of trees, only a few of them are at present on the market. Hence it is incumbent upon the forester to prohibit the cutting of rare or valuable species and to retain their seed trees rather than to mark for felling everything which should from a silvicultural point of view be removed.

VALUATION SURVEYS.

The lack of competent men has made it necessary to stop the running of valuation surveys, and also to limit the time which should be spent upon studies of reproduction. Nevertheless, during the past year much stress has been laid upon valuation surveys and several parties charged with this work dispatched to different islands. As the nature of

the work demands a continual moving from place to place, it is seldom possible to stay any length of time in one of the small villages. Camping out in the mountains requires a good equipment of tents, blankets, and last, but not least, provisions. When camp is near the sea, good fish and oysters can be obtained; but in the mountains one has to subsist entirely upon canned goods. There is, it is true, game in abundance—wild carabaos and pigs, also a variety of birds; but the members of the party are usually too fatigued to go hunting on Sunday, and the natives with their primitive methods are not successful sportsmen. During work in the mountains of Baler, Tayabas, it was necessary to move camp about every two weeks to avoid loss of time in going to and from the base of operations. Trails did not exist, and the party was compelled to return over the line of its surveys or through the rocky beds of rivers. In such cases progress was very slow.

The work itself was done in the usual way. A straight line was run without

reference to the nature of the country, and thirty-three feet on each side of the line all trees down to eight inches were calipered. At the same time notes were taken upon reproduction, soil, etc. The main difficulty was to find good men to do the calipering, as it is requisite for them to know the trees and be able to read the numbers. Frequently it was necessary to detail two men, one to read the numbers and the other to tell the tree species. Owing to this, and the dense undergrowth, an average of only five acres could be calipered in one day.

For several weeks the writer had Negritos for guides. These people belong to the non-christian tribes, live always in the mountains and seldom descend to the villages. They build no houses and seek shelter for the night under a few palms or banana leaves. They are reliable guides, and are acquainted with the native names of all that moves or has its being in their haunts, as well as with all trees and other plants.

Two men of the party measured the height of the more important species, and a young, well educated Filipino made a careful collection of all the trees

which had either flower or fruit. In each case the tree was felled and a log six feet long was taken to be tested in the timber-testing laboratory of the Bureau at Manila; logs, leaves, flowers, etc., received the same number. Ninety-five different species were collected in this manner; another party, working in Camarines province under Forester Hagger, secured no less than one hundred and fifty-five different species of trees.

All cutting is done with the axe, a small wedge-shaped tool with a straight handle. Several efforts have been made to introduce the American axe, but so far without result. In Baler, where the natives work under American foremen, modern axes are used and also crosscut saws.

REPRODUCTION.

For reproduction studies the method described by Mr. Knechtel in No. 2 of the *Forestry Quarterly* is used. Squares of one-half an acre each are measured off and counts are made in squares eighteen feet on a side, two of these smaller squares being taken in each half acre. The trees are calipered down to



FILIPINOS SAWING TIMBER.

three inches and the reproduction is classified into four groups, viz: seedlings, saplings of one-fourth, one-half, and one inch. The variety of species is very great, as many as forty-four being found on one half-acre and thirty-nine on a square of eighteen feet. This refers wholly to trees, not counting the numerous bushes, vines, and palm-like plants.

No stem analysis and accretion studies have been made so far, as no method could be devised to do this work with any degree of accuracy. A good many of the Philippine woods, especially the hard ones, show no rings at all, and where rings are visible they are very indistinct and run together, and, what is yet more important, there seems to be no regularity as to the time which is necessary to form a ring. In young trees, the age of which could be exactly traced, we found more rings than the trees had years. This is due to the uniformity of the climate the year round.

Capt. George P. Ahern, Ninth U. S. Infantry, Chief of the Bureau of Forestry, is constantly seeking the betterment of the force and the extension of the service. In view of the fact that the Bureau passed under control of the Americans by G. O. Order No. 50, April 14, 1900, and reorganized under acts of the Philippine Commission bearing date of June and July, 1901, the amount of work accomplished has been remarkable. The revenues alone bear testimony to this. During 1900-1901, they were \$199,373.00, in 1901-1902 they rose to \$348,073.00, and in 1902-1903 they reached \$527,414.00, or a grand total of 1,074,861 Mexican pesos.

There is in contemplation an experimental station near Manila, where studies of tree growth and their development can be made, a nursery for young plants maintained, and, possibly, a school for native rangers and assistant foresters established.

THE RECLAMATION SERVICE IN CALIFORNIA.

ITS ORGANIZATION, GENERAL SCOPE, AND METHODS OF PROCEDURE, WITH SHORT DESCRIPTIONS OF THE LEADING PROJECTS UNDER CONSIDERATION.

BY

J. B. LIPPINCOTT,

SUPERVISING ENGINEER FOR THE IRRIGATION WORK OF THE UNITED STATES GEOLOGICAL SURVEY IN CALIFORNIA AND FOR THE COLORADO RIVER.

THE main office of the Reclamation Service in California is located in the Byrne Building, in Los Angeles. A branch office has been opened at 431 Ri-alto Building, San Francisco; at Yuma, Arizona, and at Bishop, in Inyo county. The organization is entirely under the civil service, and the appointment of all the men has been by competitive examination.

Sacramento Valley.—Mr. H. E. Green, engineer, is in charge of the study of the drainage basin of the Sacramento Valley with a view to its development by irrigation. His headquarters are at the San

Francisco office. From present information it is believed that during the spring and early summer sufficient water is normally found in the streams to provide for a very extensive system of irrigation. The Sacramento River, however, is a navigable stream, and it is not deemed wise to make extensive diversions therefrom during the low stage of the river or its tributaries in the middle and late summer months. The water to be supplied for irrigation during this low stage must be supplied from storage reservoirs to be located either on the main stream or on its tributaries. The investiga-

tions, therefore, in this drainage basin have been preliminary explorations for reservoir sites and the determination of the available water supply.

In this work particularly, and other work in general, the State of California is extensively coöperating with the U. S. Geological Survey in carrying out these investigations, the state paying a material portion of the field expenses, and the Geological Survey paying the salaries of the employés. The governor of the state is particularly active in his desire to assist in the development of this section by an exhaustive study of its resources, and by bringing the attention of both the nation and the local public to the latent opportunities.

In addition to the work of the Geological Survey, the forest cover of the mountainous portion of the basin is being studied by Mr. Gifford Pinchot, Forester of the Agricultural Department, and his assistants, with a view to preserving the forests and thus protecting the water supply. The Topographic Branch of the Geological Survey is also receiving assistance from the state and is concentrating its efforts in the preparation of a contour map of the irrigable lands of the Sacramento Valley. About six topographic parties are now in the field carrying out this work. They are making their maps on the scale of 2 inches to the mile, with 5-foot contour intervals.

Cache Creek.—Cache Creek is one of the large tributaries of the Sacramento, entering the valley from the Coast Range. This tributary was extensively studied for the Geological Survey by Mr. A. E. Chandler, the present state engineer of Nevada.

A very extensive opportunity for impounding water economically in Clear Lake has been found and the subject discussed in an irrigation and water supply paper entitled "Storage of Water on Cache Creek." Within the past year all of the water rights of Cache Creek have been concentrated under one holding by certain parties living in Woodland, their intention being to develop Clear Lake as a reservoir site for the irrigation of the lands of Yolo county. It is understood that the ob-

ject of this concentration is the general development of the county.

The agents of the Geological Survey have held numerous conferences with these gentlemen with a view to having this work undertaken under the Reclamation Service. The Survey was inclined to make favorable recommendations to the Secretary of the Interior bearing on this subject, provided a favorable adjustment of water-right questions could be arrived at with these owners. After negotiations had been carried on for several months, assisted by the governor of the state, it was found impossible to reach a conclusion with the owners which could be recommended by the engineers of the government to the Secretary of the Interior. It was a matter of regret that this adjustment could not be accomplished, as it is believed natural opportunities of marked merit exist here, and the broadest development of these lands and prosperity of the community would be assured by this means.

The entire project hinges on the use of Clear Lake as a storage reservoir. This body of water, covering 40,000 acres, has been declared as navigable by several acts of the California legislature, and it is a serious question whether it can be used legally without the consent of the government. It is not deemed advisable to legally contest this point at present. The California Water and Forest Association, as well as the Woodland Chamber of Commerce, coöperated with the Geological Survey in the investigation of Cache Creek.

Stony Creek.—Stony Creek is a western tributary of the Sacramento. In coöperation with the California Water and Forest Association, as well as with the Willows Chamber of Commerce, the Stony Creek basin was investigated by the Geological Survey; numerous reservoir sites were found thereon, and gaging stations established, the records on which are still being continued. A report on this drainage basin known as The Storage of Water on Stony Creek, California, has recently been issued by the Geological Survey.

Putá Creek, another tributary of the Sacramento, has been explored during

the past season; a reservoir site found thereon, and a gaging station established.

Upper Sacramento.—A general reconnaissance has been made of the upper basin of this river, and a number of reservoir sites of marked value have been found, notably at a point near Red Bluff and at Bieber. These great reservoir sites could be used in connection with the general program mentioned above for supplementing the available late summer water for irrigation in the Sacramento Valley. Other sites have also been found, particularly on the South Fork of Pitt River. Gaging stations have been established at all of these sites to determine their available water supply, and during the coming season detailed surveys will be made of them. In all, records of flow are being maintained at ten gaging stations in the valley of the Sacramento River, and the entire time of an engineer has been assigned to the maintenance of these records. These will be continued until a complete report is made outlining the general possibility of developing this great valley in a comprehensive way, and in such a manner as not to interfere with navigation.

It will be desirable in connection with this general study to investigate the overflow problem of the low valley lands and consider the subject as a whole. There is apparently a very small area of public land available for irrigation in the drainage basin of this stream, and the general development of the country will be dependent upon the organization and coöperation of a great number of individuals who are now land owners in this district. It is a matter worthy of note that both the National Irrigation Association and the Trans-Mississippi Congress, during the past season, have passed general resolutions favoring the construction of great public irrigation works on the Sacramento River. The undertaking will be vast. The province of the Geological Survey is to make a complete report to the Secretary of the Interior and the governor of California outlining the latent possibilities.

Probably no section of arid America

has greater natural resources or has left them in a more undeveloped condition than the Sacramento Valley. Favored by geographic location, climatic conditions, soil, and water supply, this valley should be one of the densely populated districts of the United States, rivaling in wealth and prosperity the famous valley of the Po in northern Italy, which it so closely resembles.

Owens Valley.—Owens Valley is situated in a district that is sometimes called "undiscovered California." It lies on the eastern side of the Sierra Nevadas, in Inyo county, flanked by the most rugged and picturesque range of mountains on the continent, blessed with a copious water supply, but isolated because of imperfect transportation facilities. Mr. J. C. Clausen is the engineer assigned to the study of this district. Probably a large area of arid public land may be reclaimed here. All the remaining public lands in this locality have been withdrawn, subject to entry only under the Reclamation Act.

An extensive reservoir site has been found on the main river above Bishop, and this has been surveyed in detail during the past season. The irrigable lands are now being mapped and classified. The whole situation is dependent on the factor of the remaining available water supply. In order to determine this point the capacity of reservoirs must be found, the flow of the streams determined, and the present diversions of canals closely gaged. Mr. Ralph S. Hawley is devoting his entire time to these water measurements, maintaining eighteen gaging stations in the Owens Valley district. The people of this community are extremely anxious to have the government store the surplus flood-waters and regulate the stream flow, not only for the benefit of their lands, the supply of which is now somewhat irregular, but also for the extension of the irrigated areas. It is probable that a drainage system in connection with the general development will have to be constructed, as large areas of land in this valley have been ruined by the excessive use of water, and it is believed that the available acreage can be materially increased by their adequate drainage.

From discussions with railroad officials and the people of the valley, the conclusion is believed to be fair that with a general development of the valley by the federal government transportation facilities will be greatly improved and railroad connections established with the south, which is the natural outlet of the valley, connecting with southern California points. The work in the moun-

reservoir sites of large capacity on this stream for the regulation of the water supply and the extension of irrigated areas.

At the time this report was made all the canals on King's River associated themselves in an organization known as the King's River Storage Association. The platform on which they stood was to the effect that they had been spend-



UPPER DRAINAGE BASIN OF KING'S RIVER.

tainous portion of the district has been discontinued owing to the winter season, but will be renewed in the early summer.

King's River.—The U. S. Geological Survey has made extensive investigations of the drainage basin of King's River and the lands irrigated therefrom. A report has been published under the title "Storage of Water on King's River, by J. B. Lippincott." This report points out the possibilities of utilizing certain

ing about \$40,000 a year in lawsuits over these waters, and they considered it more desirable to construct works to increase the water supply than to litigate over the natural flow. The great result which this association accomplished was to reach an amicable agreement among themselves for the proper division of this water. Schedules have been arranged which determine the division of waters under all varying vol-

umes for the different periods of the year. Litigation has practically ceased and good will prevails. Probably fifty lawsuits have been dismissed as a result of these agreements. This association joined forces with the Geological Survey for the examination of this district. At the request of the president of the association the engineers of the Reclamation Service went to Fresno, and, at an extended meeting with them, explained the operations of the Reclamation Service with a view of constructing these reservoirs as public works. The matter was thoroughly discussed at two conferences held at Fresno in November.

The flow of King's River is peculiarly adapted to the needs of this district, or inversely such crops and agriculture have been developed in this locality as best suit the flow of the stream. In other words, the vineyards, if supplied with a copious volume of water in the spring and summer, when the river is normally at its flood flow, are able to produce satisfactory crops without further irrigation in middle and late summer. The dairy industry, however, which is now beginning to be developed in this region, requires a continuous water supply. The operations of the reclamation law were fully explained to the officers of the King's River Storage Association, representing some twelve or fourteen canal companies, and it remains largely with them to say whether the construction of these reservoirs under the federal law shall be undertaken. The sentiment expressed at the meeting was rather unfavorable to the procedure because of the expense involved and because of the general satisfaction with present conditions.

Since the investigation of 1900 nearly all the canals diverting water from King's River have increased their capacities, and it will be necessary for them to make some concessions of water from the spring and early summer flow, and also from the midwinter flow, in order to adequately supply the reservoirs considered. This water would be available for use in late summer. The flood water that could be saved and augmented by the present supply used for irrigation would be the floods of Febru-

ary and March and a portion of the highest water of April, May, and June. The policy of the department prohibits any effort at the promotion of irrigation enterprises on a community, and they will not act as advocates in this or any other situation for the construction of public works.

Salinas.—The drainage basin of the Salinas River was investigated by Mr. Homer Hamlin, engineer, United States Geological Survey. An elaborate report has been prepared and is now in the press. It shows the possibility of developing the Salinas Valley by impounding a reservoir on the Arroyo Seco. Plans and estimates are given in detail, irrigable lands are shown, and a map presented showing the depth to ground water and the possibility of obtaining the water supply by pumping therefrom.

Santa Barbara.—One of the most delightful districts in the State of California is the narrow coastal plain near Santa Barbara. Unfortunately, this district does not have an adequate water supply from local drainage basins. The U. S. Geological Survey, coöperating with the city of Santa Barbara, has prepared a series of topographic maps covering all the lands on either side of the mountain range, and particularly in the drainage basin of the Santa Ynez River. Following this topographic survey, explorations were made for reservoir sites in the basin of the Santa Ynez. The Santa Ynez River flows in a northerly direction, but on the eastern side of the Santa Ynez range of mountains it is separated from Santa Barbara by this range.

The stream flow is of a very spasmodic or erratic nature, passing off in great flood waters almost entirely in the mid-winter season, and in the summer season dry throughout the greater portion of its course. These storage reservoirs, if built, would catch these winter floods and hold them for summer use. The reservoirs were surveyed, stream records have been kept, and following these the city has located a tunnel line from a point below the reservoir sites on the river to a point on the south side of the range. While it is proposed that the city construct this tunnel, it is their

KING'S RIVER A SHORT DISTANCE FROM THE MOUNTAINS WHERE IT RISES. LOOKING UPSTREAM.



policy to permit it to be used by others who may construct reservoir sites in this mountainous drainage basin. The tunnel will be 4 miles in length between portals. The interests of the city consist, not only in obtaining an adequate water supply for domestic purposes, but in assisting the general development of suburban property.

As a result of the investigations by the Geological Survey, a bond election has been held in Santa Barbara and funds have been voted, almost unanimously,

the Mexican line will be finished soon. This map will show all reservoir sites as well as all the irrigable lands, and the basis for a comprehensive and exact study of the irrigation situation along this stream.

The Topographic Division of the Geological Survey, in coöperation with the Imperial Company, is to make a topographic map of the entire irrigable district from Inyo south to the Mexican line and east to the Colorado River. This will be a very satisfactory basis



DAM SITE ON THE LOWER COLORADO. TWO MILES BELOW NEEDLES BRIDGE.

for the construction of the tunnel line. The building of reservoirs will probably follow. Full details of the investigations are now being printed in a water-supply paper entitled *Storage of Water in Santa Barbara County, California*.

Colorado River.—During the winter season practically all the work of the Geological Survey for the California Division in the Southwest is being concentrated along the Colorado River. It is in charge of Mr. E. T. Perkins, engineer. A general topographic map in 10-foot contours of all the lands between the mouth of the Grand Canyon and

upon which to study a general distribution system.

Detailed investigations are now going on upon which will be based plans and estimates of a project to irrigate the lands both in California and Arizona, above and below Yuma, all of which data are to be submitted to the Secretary of the Interior for his consideration. Two diamond core drilling outfits are at work on the river above Yuma, prospecting for bed rock upon which to found diversion structures. Definite canal locations are being made, both on the California and Arizona side, upon

whole estimates of cost will be based. Probably 100 men in all are engaged in these engineering parties, and it is hoped that the work will be so far advanced that a definite report may be made during the coming summer. The Yuma Indian reservation on the California side, under existing laws, may be thrown open to entry when the lands are irrigated, and allotments of five acres made to Indians now residing thereon. On the Arizona side there is a considerable area of public land that can be reclaimed, and a large amount which is now either entirely arid or partially irrigated in private holdings can be benefited.

The engineering problems on the Colorado River are difficult and probably among the most complex that will be encountered in the arid region. There is no reason for believing, however, that they cannot be favorably

solved and works constructed that will give satisfactory results. Probably the greatest opportunities in the Southwest for very extensive irrigation development lie along this great stream. The volume of the available water supply, the area of the irrigable lands, the fertility of the soil, and the character of the climate, all point to a very great development. The district would be tributary in trade to the towns of southern California and is believed to offer probably the greatest latent resource back of the coast district. Reservoir sites of large capacity have been found in the upper portions of this stream to supplement the low stages of the river, which fortunately occur in mid-winter. The locality, however, is what may be termed a "twelve-months country"—one that can be farmed continuously throughout the year.

THE SOUTH PART OF PIKE'S PEAK FOREST RESERVE.

INTERESTING NOTES ON FIRE CONDITIONS, WATER CONSERVATION AND MOUNTAIN TIMBER IN COLORADO.

BY

JACOB C. BLUMER,

BUREAU OF FORESTRY.

THAT part of the Pike's Peak Forest Reserve lying south of the Manitou and Pike's Peak Railroad, or "Co. Road," embraces seventy-nine square miles of the Rampart Range of the Rockies in central Colorado.

This tract extends through fully 7,000 feet of altitude. The vast, shadowy heights that form it rise abruptly out of a great plain that lies at 6,500 feet above sea-level, and culminate at 14,147 feet in Pike's Peak itself. All but a half dozen square miles in the southwest portion which approach an undulating plateau is either extremely rugged, or steeply sloping in every direction, save a few "parks" or mountain meadows.

The geologic feature is a coarse, pink, rapidly disintegrating granite. Hardly another formation occurs except in the irregularly projecting southeast arm of the reserve, where a hard, gray granite, occasionally mixed with massive quartz, predominates.

The paucity of the flora is noticeable, and yet the number of species on this comparatively small tract is surprisingly large. The paradox explains itself when one bears in mind the great variety of altitudes, slopes, and aspects which occur, each with a climate of its own.

The Cripple Creek gold-mining district, with its 35,000 people, begins about five miles away in the mountains to the

Illustrations, including frontispiece, through courtesy of the Bureau of Forestry, U. S. Department of Agriculture.

policy to permit it to be used by others who may construct reservoir sites in this mountainous drainage basin. The tunnel will be 4 miles in length between portals. The interests of the city consist, not only in obtaining an adequate water supply for domestic purposes, but in assisting the general development of suburban property.

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west; Colorado Springs, Colorado City, and Manitou, with nearly as many, lie eastward just under the mountains; and Pueblo, supporting as many more, some thirty-five miles south on the plain. The Short Line Railroad (which cost \$80,000 per mile) connects Colorado Springs with Cripple Creek, winding over the east and south parts of the region. Many thousand tourists view the scenery from its trains every summer. The "Cog Road," running one to six or more of its unique trains daily during the season, unites Manitou with the summit of Pike's Peak. Several wagon roads lead over the more approachable parts of the tract. One of these, called the "Circle Drive," was constructed at considerable cost by Gen. William J. Palmer during the past summer, and opened to the public. Burro trails follow many of the mountain streams, giving rest and refreshment to the jaded health-seeker from the hot and dusty thoroughfares of the city. The prospector, in search of gold, penetrates every cove and gulch, and truly leaves no stone unturned. Numerous shafts and tunnels have been sunk, but no pay ore has been shipped as yet.

Perhaps the most refreshing fact that appeals to the visitor upon arriving at Colorado Springs is the abundance of clear, cool, mountain water that flows from the street-corner fountains. At great cost the city secured this priceless boon of nature by an extensive system of pipe lines, tunnels and reservoirs, chief among the latter being Lake Moraine, between Pike's Peak and Mt. Baldy. The per capita water consumption, some 300 gallons daily, is said to be the largest of any city in the United States.* The supply becoming inadequate, the city is now building two large new reservoirs at Seven Lakes and boring a half-mile tunnel as an outlet.

On the west slope of Pike's Peak, at timber line, lies a reservoir that waters the city of Victor, in the Cripple Creek district. At the southwest corner of the reserve is the large reservoir of the Woods Investment Co., valued both for the water itself and as a source of power for the ore mills and factories of Pueblo and the Cripple Creek district. The

* See frontispiece.

aggregate capacity of the present reservoirs within the tract is nearly one billion gallons.

Grazing is allowed to 2,000 head of cattle inside the reserve lines. Since they forage only on the "parks," no harm is done to the forest. They will need to be held within bounds, however, to save the sources of water supply from pollution.

There is a current impression that, between the wildcat saw-mill and the fire, the remnants of the Colorado forests are of late years fast disappearing. However truly this may apply to other parts of the state, it is not true on the south part of the Pike's Peak Reserve. Here the forest conditions are greatly improved from those of forty years ago. The bulk of the forest disappeared with the advent of the white man at the middle of the last century. About 1848-1850 a conflagration, or series of them, of gigantic magnitude swept almost every height and canyon of these mountains. Collected data prove this fact beyond a doubt. Fully 75 per cent of the area was devastated. Folk-lore has it that the Indian upon the approach of the whites set fire in order to drive out the game and keep it from falling to the latter's thieving shots. Ruxton, an English traveler who visited these parts in 1846, speaks in his diary of forest-covered mountains.

Since 1850 the fires have been few and small in comparison, partly because of the lack of fuel. Following the Cripple Creek gold discovery in 1892, much young growth was burned along the newly opened gold-seeker's trail. The latest fire occurred last August, on the slope of Big Chief, sixty acres of virgin or old timber being destroyed. There is at present one ranger to patrol the entire seventy-nine square miles of mountains. This is entirely insufficient. Moreover, the largest two tracts of timber yet remaining are practically inaccessible. This fact has saved them.

The decreasing water supply had much to do with the awakening of the people to the status of their forests. In July last this active interest resulted in the formation of the Colorado Springs Forestry Association.



MOUNT ROSA AS SEEN FROM THE "SHORT LINE."



EFFECT OF FIRE IN THE MIDDLE BEAVER VALLEY ONE-HALF MILE BELOW SEVEN LAKES.
ALTITUDE 10,700 FEET.

The U. S. Weather Station at Lake Moraine records no decrease in precipitation for the past ten years. This being true, the yield of water must be increased or at least more evenly distributed throughout the year on account of the improved forest conditions. Therefore the cause of the water shortage must rather be sought in the multiplied consumption of the growing industries and population.

The longest straight line which could be drawn in virgin timber still remaining is hardly a mile in length. The major portion is scattered in smaller parcels, excepting certain areas in the western and southern parts of the tract, which are practically denuded. Rather less than nineteen square miles is still covered thus with virgin forest. To this may be added six square miles of young growth thick enough to replace the original stand, making a total of twenty-five square miles, or thirty-one per cent, that may be called forested. More or less reproduction exists wherever the great fire scourge left a crippled tree to bequeath its legacy of seed to Mother Earth before it died. The area thus occupied embraces some twenty-eight square miles.

After deducting three-and-one-half square miles for land above timber line, an equal area for "parks," lakes and reservoirs, and one square mile for talus slope covered with loose gravel or rock, there remains an area of eighteen square miles, or nearly twenty-three per cent, without any forest growth whatever except the ubiquitous aspen. This area, and especially those portions of it which at higher altitudes partly cover the sources of the different water systems, needs afforesting attention. However, the greater part of such work here, as elsewhere on the tract, must be left to Nature. The one paramount part that man must play is—*keep out fire*.

The aspen exists abundantly in all altitudes and aspects of denuded land to timber line; yet some areas form curious exceptions. It is of various ages up to fifty years, but almost never older. Only in a few instances does it fulfill the office of nurse to the conifer much younger than itself. The case is con-

spicuous by its general absence. Not only is this true far from seed-trees, but on seemingly favorable sites among trees that have borne cones at least ten years ago. The Engelmann spruce, under best conditions, bears its first cones at about twenty-five years of age, while twenty years approximates for limber pine. Why no reproduction takes place is one of the problems to be solved.

The reproduction of Engelmann spruce is practically even-aged. The overwhelming number are from thirty-five to forty-five years old. Limber pine and red fir both predominate at twenty-five to thirty, coming in after the fire more tardily as well as more persistently. These three form the bulk of the young generation, with the Engelmann spruce far in the lead.

A striking feature of these high woodlands is the great amount of dead timber standing and lying among the living. It is not unusual to see every third one of the standing trees dead. The novice concludes that the forest is dying by some unknown pest. The investigator finds that these trees have long been dead, and are preserved intact like the mummies of Egypt. The great preservative is the dry, cool rarity of the Rocky Mountain air, which is death to the organisms of decay. Timber killed by the fire half a century past is to-day sold at Colorado Springs at \$4.50 per cord. For mine timbers it is preferred to green wood. To lessen the fire danger, it should be removed wherever there is much young growth.

The eleven cone-bearing species that follow are mentioned inversely to the order of their relative abundance, which probably coincides with the order of importance viewed from the standpoint of water conservation.

Only four or five specimens of lodgepole pine (*Pinus murrayana*) were discovered in as many months of observation by several men. A few red juniper (*Juniperus scopulorum*) occur along the south boundary of the reserve, in the valley of Little Fountain Creek. In the same locality is found a considerable sprinkling of the bushlike pinyon (*Pinus edulis*). Isolated seedlings were seen elsewhere as high as 9,700 feet.

Jack* reports it in but one place within the reserve—that is, William's Canyon, near Manitou, at 8,000 feet. A small number of blue spruce (*Picea parryana*) find a habitation below 8,500 feet in the sunny swales of the southwest portion of the reserve and on Little Fountain Creek. The alpine fir (*Abies lasiocarpa*) is curiously restricted to one or two square miles between 10,000 and 11,000 feet on north slopes in the upper North Cheyenne Basin. Few old and many young trees seem to indicate that

the remainder being red fir. It holds its own in the reproduction of burned areas, and, like its congener just preceding, is the first to spring up after fire.

The bristle-cone (*Pinus aristata*), also called range pine and foxtail pine, is a tree of habitual decrepitude. It finds foothold on many dry, exposed westerly slopes down to 9,000 feet or less, as well as at highest forest altitudes up to 12,000 feet, where it clings to the inhospitable rocks in grotesque forms and defies the arctic storms. While it has borne cones



TALUS SLOPE AT 11,500 FEET. SHOWING SCRUBBY RANGE PINE AND ENGELMANN SPRUCE.

it is an adventive species. It was first to spring up after the fire, preceding the Engelmann spruce by about five years. As high as 5 per cent occurs in mixture with a dense stand of the latter.

The white fir (*Abies concolor*), locally known as balsam, is limited to parts below 9,000 feet, and here mainly to the southeast arm of the reserve. It has been observed in pure stand and forms more than half of some virgin slopes,

*Jno. G. Jack: Part V, 20th Annual Report, U. S. Geological Survey.

quite generally, often for three successive seasons on the same tree, it shows the smallest relative number of seedlings. These are found only near mountain tops and on exposed high ridges. The wood is not readily accessible, but has high fuel value. Because of larger pitch content, this value increases with higher altitude. The fire-killed timber was formerly much used in making charcoal for the smelters. One ton of wood yielded 100 bushels of charcoal, worth 11 cents per bushel.

The two trees that occupy by far the largest share of the land under 9,000 feet altitude are the rock pine (*Pinus ponderosa scopulorum*, also known as bull pine or yellow pine) and red fir (*Pseudotsuga taxifolia*).

They are almost coextensive in distribution, yet seldom occur in mixture. While the first, in its usual open habit, covers the southerly slopes and more level country, the latter, in much denser stand, takes to the steeper, cooler slopes. It makes the most abundant and generally distributed young growth below 9,000 feet. The pine also reproduces readily where chance is given. It is a good fuel wood and yields some clear lumber. The red fir is locally known as red spruce and esteemed the best timber of the region. It is much sought for lumber, mine timber, ties, poles, and piles.

The tree which eventually will thickly dot even the barest southerly slopes between 9,000 and 11,000 feet is the limber pine (*Pinus flexilis*), natively called white pine; but the process is extremely slow. In the situations mentioned a few bodies of timber composed mainly of this tree are left, yielding many ties and mine timbers, and some saw-timber. It usually makes a fairly straight log twelve to sixteen feet clear. Its fuel value ranks close to that of bristle-cone pine. Owing to its rather dry, sunny habitat,

it ranks as a water-conserver probably no higher than red fir.

To the Engelmann spruce (*Picea Engelmanni*), locally known as white spruce, easily belongs the preëminence as a water-conserver of these mountains. Following the streams of the canyons as far down as 7,000 feet, it covers in more or less pure stands most of the northerly slopes from 9,000 to 11,500 feet, and finds its ideal realm in the frigid shadows just below the timber line. Commercially it is as yet of no great moment, owing to difficulty of access as well as knotty and often twisted bole. Nevertheless, some lumber has been sawn from it, and the tree may become valuable as pulp wood. It is ordinarily of very slow growth, but varies in dimensions between great extremes. A tree half a hundred years old may be one foot or fifty feet in height. Ten years under favorable conditions will suffice to grow good-sized catalpa poles. Some pole stands of Engelmann spruce of similar size occur that have taken 250 years to grow. Eight thousand forty-year-old trees have been counted upon one acre. It is this unusual and persistent density, together with the shady slopes at high altitudes, that preserve the snow for eight to nine months of each year, feeding the streams as they need it the water of life for the thirsty fields and multitudes below.

RECLAMATION OF ALKALI LANDS IN UTAH AND CALIFORNIA.

COMPILED FROM CIRCULARS NOS. 11 AND 12 OF THE BUREAU OF SOILS, U. S. DEPARTMENT OF AGRICULTURE.

BY

THOMAS H. MEANS AND W. H. HEILEMAN.

A Demonstration Near Salt Lake City, Utah, in Coöperation with the Utah Agricultural Experiment Station:

In 1899 a party from the Bureau of Soils made a soil survey of that portion of the Salt Lake Valley lying west of the Jordan River. In this report full con-

sideration was given to the question of the alkali soils around Salt Lake City, the cause of their formation, their character and present extent, and the means of their amelioration and reclamation. The following paragraphs are taken from this report:

"On the west side of the Jordan River the earliest attempts at irrigation were on the Jordan meadows, or river bottom lands, the water supply being obtained from the Jordan River by means of small canals. Subsequently the Brighton and North Point and the North Jordan canals were run upon the first terrace above the river, and following these were the South Jordan and the Utah and Salt Lake canals on the second and third benches, respectively.

"As is frequently the case, the irrigation on the benches caused an accumulation of seepage and alkali on the river bottom land, so that much of it has been abandoned. The largest and most seriously damaged area, however, is just south of Twelfth Street road, and comprises a strip of land varying from half a mile to a mile and a half in width, and extending 10 miles west from the river. Here the seepage and surplus waters from the outer extremities of the Utah and Salt Lake, the South Jordan, and the North Jordan canals have collected to an alarming extent. Indeed, the damage has gone so far that a chain of lakes has formed, presenting a water surface of fully 1,000 acres. The area affected is not less than 10 square miles.

* * * * *

"The seepage and waste waters from the canals account in great measure for the 10 square miles of good land which has already been ruined by seepage and alkali. It has been shown that the water is of good quality, and the lands of the upper benches are naturally free from any great excess of alkali; but the continual seepage from the canals during the growing season for a great many years has transported a quantity of salt to the lower levels.

"The application of water on the lowlands west of Salt Lake City, where there is a large amount of alkali in the lower depths, has been attended with very disastrous results to crops. The salt has quickly risen to the surface and, even where the surface foot was originally free from alkali, the crops have been completely ruined in the course of two or three years."

In order to bring a matter of so much importance to the attention of the farm-

ers and the community at large, an experiment to demonstrate the value of drainage in alkali reclamation was planned. In the carrying out of the work the Utah Experiment Station entered into coöperation with the Bureau of Soils, and in 1902 a tract of 40 acres, belonging to Mr. E. D. Swan, was selected for the demonstration. This tract lies 4 miles west of Salt Lake City, about half way between the two railroads running directly west from Salt Lake City to Salt Air and to Garfield Beach. The nearest railroad station is Buenavista, distant one-fourth of a mile from the tract, on the San Pedro, Los Angeles and Salt Lake Railway.

The land, at the time work was commenced, was all strongly impregnated with alkali salts, and had nothing growing upon it except a few alkali weeds, the most prominent of which was greasewood. The land was considered valueless by the farmers of the neighborhood.

The tract lies on the east side of Williams Lake, and at its highest point has an elevation of about 8 feet above the part of the lake bed adjacent to the tract. The sketch map shows the plan of the tract and the size, depth, and distance apart of the draintile installed.

The cost of this installation was as follows:

270 ft. 10-in. tile, at \$100 per M ft. . . .	\$27 00
300 ft. 8-in. tile, at \$64 per M ft.	19 20
520 ft. 6-in. tile, at \$27.50 per M ft. . . .	14 30
6,580 ft. 4-in. tile, at \$17 per M ft. . . .	111 86
2,890 ft. 3-in. tile, at \$13 per M ft. . . .	37 57
Fittings.	2 80
Freight on 3 carloads, Ogden to Buena-	
vista.	60 00
Cartage and scattering tile	17 50
606 rods ditch, at 50 cents per rod. . . .	303 00
67 rods main ditch, at 54 cents per rod. .	36 30
673 rods covering with team.	19 50
150 feet outlet ditch (open).	6 00
One-fifth cost of tools	5 00

Total cost \$660 03

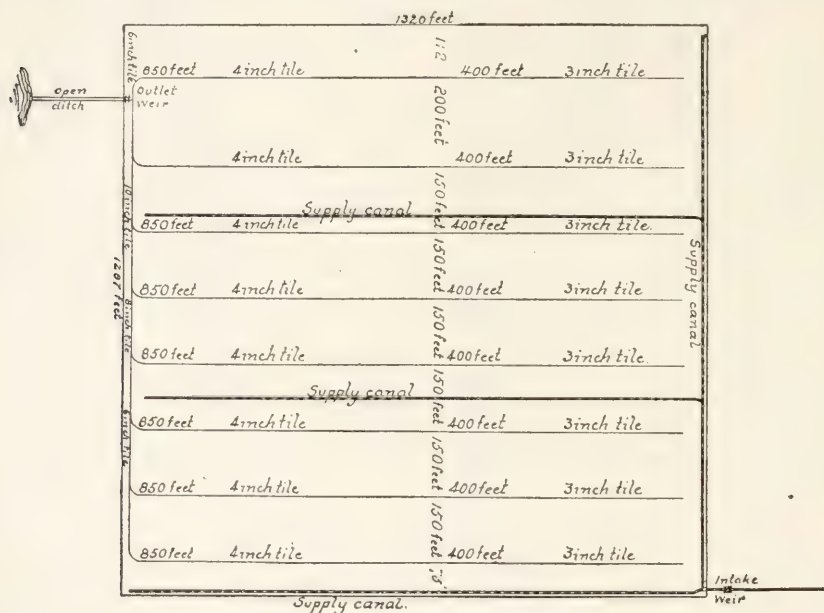
The average cost of the drainage system completed was \$16.50 per acre, and it is believed that the drainage of larger tracts could be accomplished at about the same cost. Some of the stated items of expense could be considerably reduced, but others would be greater. For example, while it might be possible

to obtain better prices on tile, if purchased in larger lots, the drainage of any more extensive area would require the digging of an outlet either to the Jordan River or to Great Salt Lake.

The tract is composed of a surface soil of loam and sandy loam, with a depth ranging from 12 to 18 inches. The underlying material is a heavy clay. A very shallow sand stratum occurs at a depth of 4 feet over the greater part of the tract. The lower or lakeward half of the tract is underlain at an average depth of 26 inches

from inch cubes to granules about as large as buckshot. When wet, it still breaks on regular lines of fracture, but materially softens, and if thoroughly plowed loses its hardpan properties. In excavating during the drainage installation it was necessary to break the dry material with a pick, as was also the case with the white hardpan.

With the above soil and hardpan conditions it was deemed advisable to place the drains 150 feet apart, and this interval was used except in one instance. The system for the 40 acres includes



PLAN OF OPERATIONS NEAR SALT LAKE CITY.

by white calcareous hardpan from 1 to 2 inches in thickness. Occasionally two strata of this hardpan are found, the first lying about 4 inches above the second.

Another special soil feature occurs in places in the tract. This consists of a layer of peculiar brown material, somewhat inclined to fracture along lines after the manner of adobe, and yet maintaining in the interior part of the layer a hard, impervious core. This material is found at from 4 to 12 inches beneath the surface. When it is turned with the plow in a dry condition, it breaks into particles ranging in size

eight lateral drains and one main drain. Each of the laterals is 1,250 feet long, and is laid with 850 feet of 4-inch and 400 feet of 3-inch drain tile. The exception already referred to is in the interval for lateral No. 8, which is laid 200 feet from the nearest lateral, the object being to study its efficiency under such conditions of soil as exist in this tract.

The main drain is put in across the lower part of the tract, 20 feet from its west side, and is met by seven of the laterals. This drain was laid with 270 feet of 10-inch, 300 feet of 8-inch, and 520 feet of 6-inch tile.

The 10-inch tile in the main drain have a capacity sufficient to remove 4 inches of water per week from the adjacent lands, or lands underlain by laterals Nos. 1 to 7. Ordinary operations for reclamation do not overload the drains, however, since the factors of summer evaporation and subdrainage through the soil play important parts in the disposal of the water added in flooding operations.

Over the great part of the tract the drains were laid at a depth of 4 feet. In that part nearer the lake a somewhat shallower depth was necessitated in order to obtain a gravity outlet for the drainage water. The drains were laid on a grade of not less than one-tenth foot in 100 feet, except where 3-inch tile was used when the grade was somewhat higher. The illustration (Fig. 1), is a plan of the completed system, and shows the supply canals, position of the weirs, drains, and the position and extent of the different sizes of tiles. The system as installed has proven adequate. Flooding has been carried on systematically, the land being divided into checks and plats by levees, and each plat treated in rotation. During each flooding water has been added to an average depth of 4 inches. The movement of the water into the soil has been regular, and, considering the character of the clay subsoil, rapid, and the drains have quickly filled after the floodings and have run freely throughout the experiment.

During the last season (1903) the land was flooded once each week, with occasional longer intervals when the supply canal was being repaired or during times when the land was being plowed or the levees repaired.

Before any water was applied to the tract a detailed survey was made to determine the alkali content of the soil. This initial survey was made in September, 1902. The land was then flooded once and allowed to remain until the next spring.

In May, 1903, before work was commenced, a second survey was made, and a third survey of the tract was made in October, 1903, after the close of the season's operations.

The following table gives the tonnage of alkali in the tract, as shown by these surveys:

	September, 1902.		May, 1903.			October, 1903.		
	Alkali in 40 acres.	Per cent of total.	Alkali in 40 acres.	Per cent of total.	Per cent lost ^a	Alkali in 40 acres.	Per cent of total.	Per cent lost ^a
	Tons.		Tons.			Tons.		
In first foot.....	1,363	20	499	14	63	101	8	92
In second foot.....	1,540	23	650	19	58	183	15	88
In third foot.....	1,766	27	1,066	31	40	330	28	82
In fourth foot.....	1,982	30	1,265	36	36	607	49	69
Total.....	6,651	.....	3,480	.....	49	1,221	.....	82

^a Shows the proportion of the salts removed as compared with the salt originally present in the various depths.

The data given in the above table shows that between September, 1902, and the following May, 3,171 tons of salt had been removed from the soil to a depth of 4 feet, and that between September, 1902, and the following October, 5,430 tons had been removed, or 82 per cent of the alkali originally in the first 4 feet of soil. It is also seen that a greater proportion of the alkali has been washed out of the surface foot than out of the lower depths, and that the movement of the salts is less pronounced as the depth increases. Thus originally the fourth foot carried 30 per cent of the total salt, while in October, 1903, the fourth foot carried 49 per cent of the salt then remaining in the soil. There has been, however, a marked decrease in the quantity of salt at all the depths, and the fourth foot has in reality lost 69 per cent of the quantity of alkali originally present.

It must be understood that these changes have taken place through the movement of the salts downward by percolating water and not through washing them from the surface of the land.

The following table shows the volume of water added to the tract from September, 1902, until October, 1903. The table shows also the volume of drainage over the outlet weir, and the salts (alkali) removed from the tract in the drainage water. The results are obtained from continuous measurements and daily collections of water samples for the entire period.

Month.	Volume of water added to tract.	Volume of drainage water from tract.	Salts in drainage water.
	<i>Cubic feet.</i>	<i>Cubic feet.</i>	<i>Pounds.</i>
1902—September....	284,400	158,700	152,200
October.....	940,000	265,000	195,100
November.....	2171,300	251,000	353,800
December.....	2166,500	139,700	187,800
1903—January.....	2291,800	257,300	391,200
February.....	2136,400	174,400	214,800
March.....	2132,000	428,000	590,700
April.....	2112,000	26,900	26,500
May.....	2576,900	521,500	567,100
June.....	2106,000	274,500	345,200
July.....	236,580	480,490	556,459
August.....	2,122,160	814,890	1,221,742
September.....	2,352,920	1,195,976	1,654,115
October.....	351,290	663,420	840,981
Total.....	10,909,620	5,651,776	7,297,697

a Fell as rain or snow.

Total volume of canal water used....cubic feet.. 9,180,140
Volume falling as rain and snow.....do..... 1,729,480

Total volume from above sources..do..... 10,909,620

Total water usedacre feet.. 250.4
Salts added in the canal waterpounds.. 900,000

The total volume of drainage was 5,651,776 cubic feet, or 51.8 per cent of the water added to the tract. This 51.8 per cent drainage water carried 3,648 tons of salts over the outlet weir. The remainder of the salts removed from the tract have passed into the deeper subsoil and been carried away by the natural subdrainage.

The results so far obtained indicate the ultimate complete reclamation of the land. The single season's operations produced marked improvement in the land, not only in the alkali content, as shown by the soil tests made, or as shown by the salts in the drainage, but also as shown in the improved tilth of the soil and favorable changes that have taken place in its physical properties.

The indications are that the greater part of the tract is at present sufficiently sweetened to allow the growing of shallow-rooted crops. It is the intention to continue the work until reclamation is complete, and the data pertaining to the process of flooding and drainage will be supplemented by practical crop tests during the season of 1904.

A DEMONSTRATION AT FRESNO, CALIFORNIA.

At the time of settlement of the country south of Fresno, there was lit-

tle indication of the presence of alkali in the soil, and no one then suspected that serious damage would result from irrigation. When, after a few years, alkali commenced to show in the vineyards and orchards the attention of thoughtful men was directed toward remedying the evil, but up to the time of undertaking this experiment nothing effective had been accomplished.

In 1900 the region was studied by the Bureau of Soils, and recommended drainage with frequent cultivation and copious irrigation as the solution of the problem.

It was decided to bring the value of drainage in reclamation work before the people by actually reclaiming some of this land.

A 20-acre tract was selected, belonging to S. M. Toft and N. H. Hansen, situated on Fig and Central avenues, about 2½ miles south of Fresno, and the work was undertaken in cooperation with these gentlemen.

The northern part of the tract had been settled upon by Mr. Toft in 1876, and at that time showed no sign of alkali. In 1899 Mr. Toft bought an additional 20 acres, at \$350 an acre, the average value of land in the vicinity at the time. The southern part of the tract was occupied in 1862 by Mr. Hansen, and at that time was partially alkaline. It has never produced good crops. In 1890 alkali commenced to show on the northern part, and in 1898 and 1899 it was practically abandoned.

The tract lies in a level district where it was impossible to obtain a gravity outlet for the drainage water, except by digging a drain 2 miles long, so in order to raise the drainage water to the surface of the ground a chain pump operated by a water wheel was installed on Central Canal, where it crosses Fig avenue. A drainage system of this kind is admittedly not so desirable as one in which a gravity outlet can be maintained.

Three-inch, 4-inch, and 6-inch tile were laid over the tract at an average depth of a little over 3 feet and 150 feet apart. The original intention was to use nothing smaller than 4-inch tile, but the makers were unable to supply enough

tile of this size, so the deficiency was made up by using 3-inch tile. It was found impossible to lay the tile during the summer season, owing to the nearness of the water table to the surface and the resulting condition of the subsoil, which was too soft to permit the digging of a deep ditch. The work of ditching was commenced in December, 1902, and was completed in February, 1903. The cost of ditching, tiling, and all incidentals except the cost of pump and water wheel amounted to \$16.50 per acre. The contract for the tile delivered in Fresno was for 3-inch tile, \$24 per thousand, for 4-inch tile, \$32 per thousand, and for 6-inch tile, \$72 per thousand.

At the time of the installation of the drains 18 acres of the land contained too much alkali to produce a crop. Scattered over a part of the tract were small patches of alfalfa and an occasional fruit tree—remnants of former cultivation. About the 1st of March, 1903, irrigation was commenced. The land was divided into 30 checks, the size of each check depending upon the slope of the land. The largest checks, those on the level land, are about 2 acres in extent, while on the steeper slopes they are less than half an acre. The object was to divide the land in such a way that it could all be kept under water to a depth of 4 inches, and the reclamation was to be accomplished by maintaining the water at this depth until enough alkali had been washed out of the soil through the drains to enable the crop to be grown.

During the progress of flooding many difficulties were met, among them that of keeping the tiles from partially filling with sand and silt. Precaution was taken in laying the tile to put them in so the joints would be close, hay was thrown over the tile in the ditch before covering with earth, and a ridge of earth was thrown up to prevent the water from standing directly over the drains. In spite of these precautions the soil, which is very light, was so easily moved by water that it seemed to enter the joints almost as readily as did the water. This resulted in some of the drains becoming clogged, and it

was necessary to relay a portion of the tile. After the land had been once thoroughly soaked and had settled, no difficulty was experienced from filling of the drains, and it is hoped that there will be no further trouble from this source. Most of the trouble was with the 3-inch tile, which is admittedly too small for use in soils of the light and silty character of the Toft-Hansen field. It is thought that there will be more or less silting up of the tiles whenever they are used in the sandy and white ash soils of the Fresno district, and it is recommended that every possible precaution be taken in putting them in. Much of the trouble may be obviated by using no tile smaller than 4 inches, or preferably 6 inches in diameter, and by giving the laterals such fall that the velocity of the water will be great enough to wash out the sand as rapidly as it enters the joints. The tile on the Toft-Hansen tract have a fall of 1 in 1,000, and the velocity of the water flowing through them is not sufficient to remove the sand. With a fall of 1 in 500, the velocity is great enough to remove practically all of the soil as fast as it enters.

To prevent entirely the clogging of the tile with sand and to insure the removal of roots should any chance to enter, it is thought advisable to place in all tile a quarter-inch galvanized strand-wire rope. Then two or three times a year, or oftener if necessary, a wire brush should be dragged through the tile in order to cut out all roots and stir up the sand and silt. Wire rope of this kind can be bought for about 1 cent a foot. Six-inch and 8-inch drains have been in operation for twelve years in the Sunnyside vineyard, and have been kept in perfect order in this way.

On July 15, 1903, after four and a half months of irrigation, an examination was made of the tract to determine what percentage of the land was sufficiently sweetened to grow a crop. This examination indicates that all of the land, with the exception of small spots amounting in the aggregate to less than 2 acres, is now ready for a crop. Most of it is sufficiently freed from alkali to warrant the sowing of alfalfa, but as

midsummer is not the best time of year for seeding that crop, sorghum and Egyptian clover are being put in instead. These crops will mature by fall if the supply of irrigation water does not fail, and in the winter the land will be seeded to alfalfa. The small spots which are not yet ready for alfalfa are rapidly approaching that condition, and will be ready for a crop during the coming winter. Thus it will be seen that practically all the land in this 20-acre tract has been returned to a state of profitable cultivation in a period of four and a half months after irrigation was commenced, and the statement seems justified that any alkali land in the Fresno district can be brought into profitable cultivation in less than one year's time, the two requisites for this being underdrainage and a copious supply of water for irrigation. While the soil experts consider the land of the Toft-Hansen field practically reclaimed at the present time, the demonstration will be continued until a satisfactory stand of alfalfa is secured.

The reclamation work on this tract has progressed so far that the most skeptical must be convinced that drainage and irrigation will reclaim alkali lands. A district of nearly 26,000 acres is now suffering more or less from alkali and seepage water, and it rests with the owners of this land to form a drainage district under the act passed by the last legislature of California, approved

March 20, 1903. The formation of such a district will allow the construction of a drainage system which will result in the reclamation of all lands now alkaline and the prevention of further damage from this source.

The system recommended, after over three years' study of the conditions, consists of tile drains varying in size from 4 inches to 24 inches. The main drain will be an open ditch, collecting the water from the parallel tile drains one-half mile apart. This main will deliver the water at the surface of the ground in the district west of Fresno, where it can be used for irrigation. Repeated analyses show that even the most concentrated of the drainage waters from this tract would not be injurious when so used if the land is properly underdrained. The main tile will be laid in approximately straight lines, increasing in size up to 24 inches in diameter. On the fields badly charged by alkali further drainage by 4-inch, 5-inch, and 6-inch tile laterals may be necessary, but such fields are comparatively few. The cost of this system, calculated on a basis of 20,000 to 26,000 acres, should not exceed \$10 per acre. The work of the federal experts legitimately ends with the demonstration now being completed on the Toft-Hansen tract. The formation of the district and the building of drains and the reclamation of land will rest entirely with the voters and the owners of the land.

A PREVENTIVE OF FOREST FIRES.

SUGGESTIONS FOR THE ADOPTION OF A SPARK-DEFLECTOR
WHICH WILL REMOVE SOME OF THE MENACE WHICH THE
RAILROADS HAVE FOR THE WOODS DURING DRY SEASONS.

BY

BRISTOW ADAMS.

IT is admitted by all who have studied the problem that a majority of the forest fires in the United States are directly traceable to the railroads which traverse long wooded stretches. Several causes tend toward this state of affairs ;

careless track crews leave their camp-fires burning, or, in destroying old material by burning along the right of way, allow the flames to get into the surrounding forests ; but the most prolific cause of all is the shower of sparks which are

thrown high into the air from the locomotive itself, and, carried by the wind, alight at some distance from the line, there to start a fire which may result in the loss of millions of dollars.

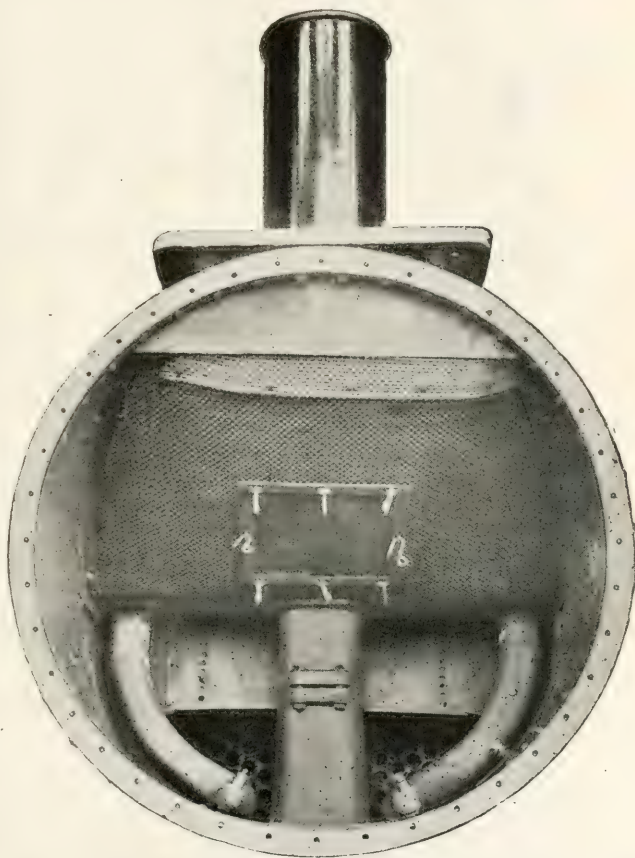
Various remedies have been suggested and devised, but they are not real remedies. Legal pressure has been brought to bear, and in many places, notably on the railroads which traverse the Adirondacks, spark-arresters are required by law; but the terrific fires which raged along these lines last year are sufficient proof that the spark-arrester belies its name.

This arrester consists generally of a coarse screen so placed that all cinders which are drawn through the fire tubes in the boiler must come in contact with it in their course toward the smoke-stack. Most of the iron netting used has a mesh not finer than two and one-half openings to the linear inch, or five-sixteenths of an inch square, and railroad men say that the steam-making capacity of an engine is crippled by using a mesh of smaller size; yet live coals as large as a pea can be thrown by the exhaust through a screen of this size. The screens are not placed in the stack, as many suppose, but are bolted firmly in the forward extension from the boiler, under the stack.

The sparks and live coals first strike a solid iron deflecting plate, which slopes forward at an angle of forty-five degrees and causes them to glance toward the bottom of this extension. Such as are carried up by the draft around the lower edge of the plate (and that means most of them) strike the wire screen, and the smaller ones pass through, while the larger ones drop back at the very front

of the boiler extension cylinder, to be raked out at the end of the trip.

The seasons for forest fires are the spring and fall, and it has been found through long observation that all of the large fires occur during one or the other of these two seasons, with the preponderance in the fall, especially in the Western states. In the Eastern states,



FRONT VIEW OF OPEN SMOKE-BOX, SHOWING IN ORDER FROM BOTTOM, ENDS OF FLUES, LOWER PART OF DEFLECTING PLATE, AND WIRE SCREEN.

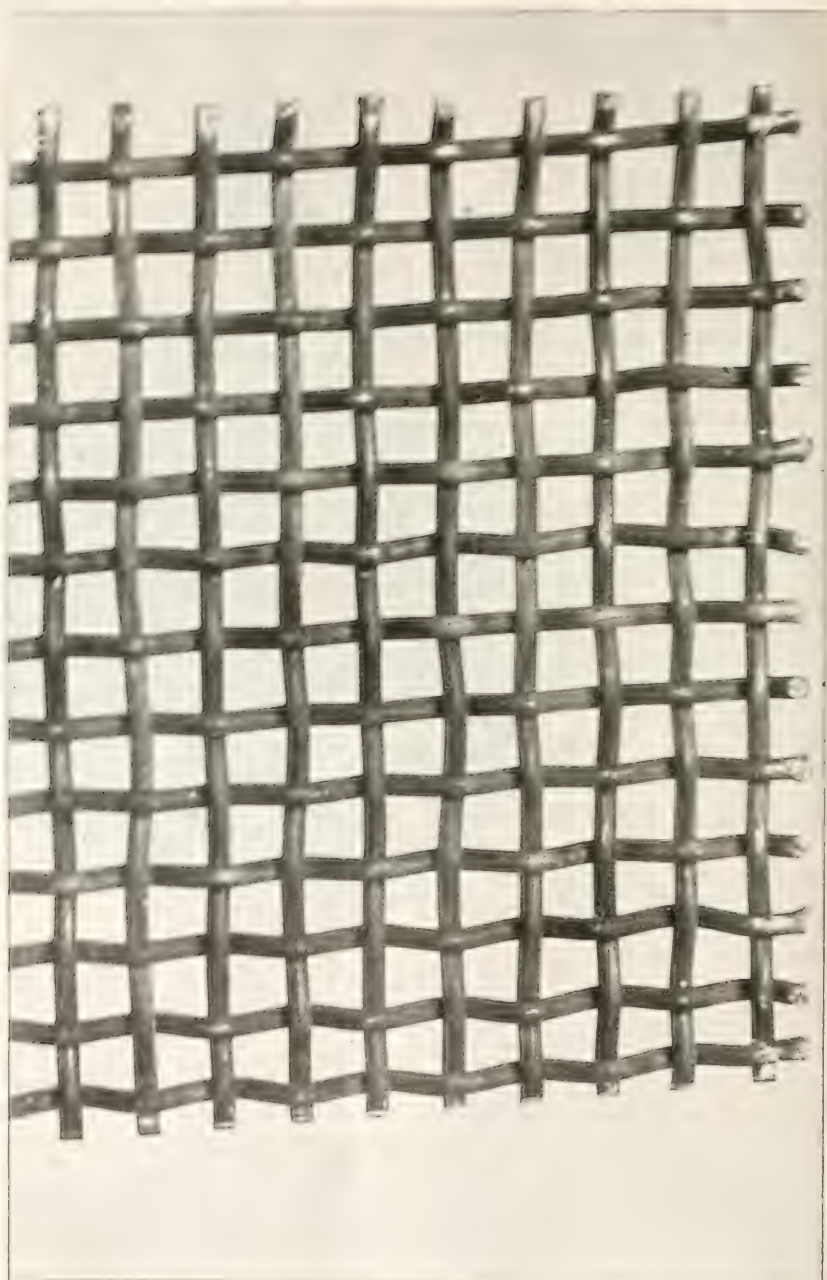
however, the spring is almost as dangerous a season as the fall, and last year's Adirondack fires were in full swing by the beginning of May.

Now, with the fire season upon us, and the spark-arresters avowedly inadequate for the purpose for which they are intended, it seems wise to look for some device to aid them in performing the work for which they were designed.

The writer of this article suggests a device well known and widely used by terracola in the West, but for a different purpose. It is used, for example, by the Hacoa People as a protection to the main shaft through which the road runs

for many miles, particularly in crossing the Sierra.

The device used is simple in construction and operation, inexpensive, and adaptable to any style of locomotive. It consists of a specially constructed

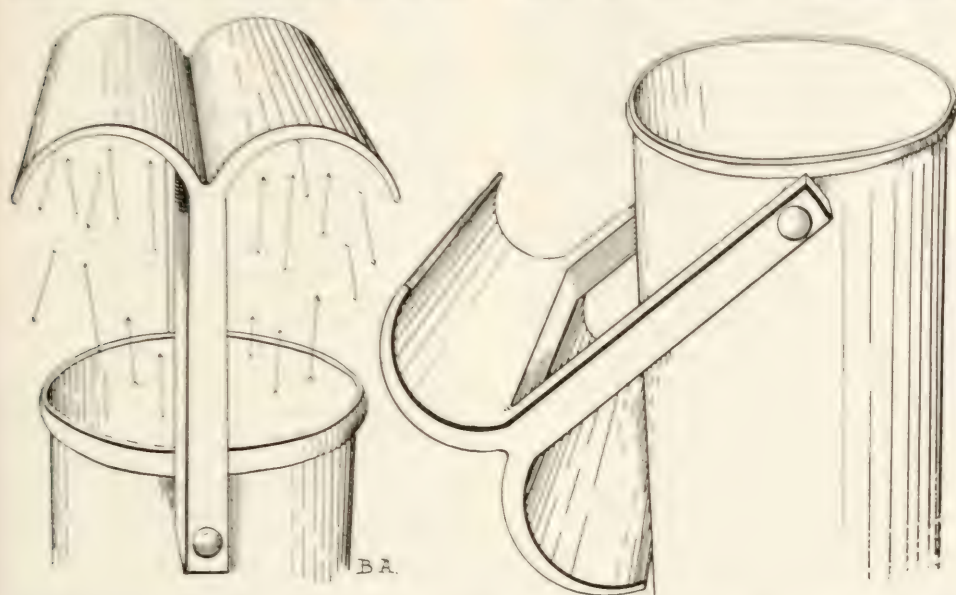


ACTUAL SIZE OF MESH COMMONLY USED IN STANDARD PRACTICE.

hood, which is held above the stack at a height of about two feet, and interferes but little, if at all, with the draft. The protection afforded consists solely in deflecting the sparks downward as they come out of the stack, thus preventing them from lodging in the roof of the snow-shed, and making them fall harmlessly on a road-bed free from inflammable material. With the rules generally in force as to the clearance of the road-bed and right of way of all combustibles, it seems that this device

course, and a spring notch holds it in its upright position. When not in use it lies at the side of the stack as shown, thus allowing it to be instantly thrown out of use to improve the draft in places where there is no forest, though it would seem that the draft necessary to run the heavy trains which cross the great divides where deflectors are used can not be very seriously impaired, considering the power developed.

The trial of some such device is suggested particularly for the Adirondack

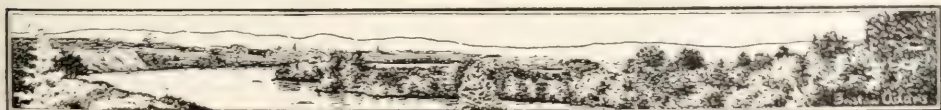


DIAGRAMMATIC DRAWING OF SPARK-DEFLECTOR IN USE ON WESTERN ROADS; FRONT VIEW IN POSITION, AND OUT OF USE.

should be effective for use in forested areas. The sparks deflected upon such a right of way would expire harmlessly, and even in the seasons of highest wind it would be practically impossible for them to roll far enough to one side to get into the dry brush of the forest without being checked by some obstruction.

A front elevation of the hood is like a letter T, with a downward curved top bar, the drawings here presented giving a fair idea of it and its use in connection with the stack. It is made of iron, of

region of the State of New York, where so much depends on the protection of the woods from fire. The deflector may not be as valuable a thing for forest protection as it is to guard the snow-sheds from fire. In short, it is put forward as an untried possibility in the use now proposed, but as a suggestion in which there may be some value, even if it serves only to start other minds toward devising some safeguard more effective than spark-arresters alone have proved.



NATURAL FOREST EXTENSION.

A STUDY OF THE TENDENCY OF FOREST TREES TO EN-CROACH UPON THE PRAIRIE IN NORTHEASTERN KANSAS.

BY

C. W. YODER.

UNIVERSITY OF NEBRASKA.

PONY CREEK flows across the northwestern part of Brown county, Kansas, and empties into the Nemaha River south of Falls City, Nebraska. For the past fifteen years the home of the writer has been on the banks of this stream, and it is here that he has had opportunity for study of the forest conditions of the region.

The timber belt along the creek varies from zero to a quarter of a mile or more in width. The forest growth consists of a mixed stand of oak, elm, walnut, hickory, box-elder, cottonwood, maple, sycamore, basswood, wild cherry, and a number of other species. A few cottonwood and sycamore trees have attained a diameter of three feet or more. Occasional stumps of oak, walnut, and elm indicate that these trees attained a similar size. A white elm stump forty inches in diameter was found to contain two hundred and seventy-five annual rings. These veterans of the forest are confined almost exclusively to the vicinity of the creek bank. The great majority of the trees are of a comparatively recent growth.

There is a marked contrast between the forest growth along the creek and that along the Nemaha River, at the creek's mouth, or the Missouri River a few miles farther east. Along the Nemaha River there are considerable areas of a stand of mature trees. Their trunks are long and free from limbs for thirty or forty feet, a feature that is even more marked in the timber belt that skirts the Missouri River. Along the creek the trees are young and vigorous. Examples of recent forestation are numerous.

On one farm there is a fifteen-acre tract composed almost exclusively of black walnut trees from six to fifteen

inches in diameter and about forty feet in height. An examination of a number of recently cut stumps indicates an age of from twenty-five to thirty-five years. The hazel brush and other shrubbery has not been completely suppressed by the encroaching forest growth.

On the opposite side of the farm, about sixty rods from the creek, a steep northern slope is covered with a dense stand of bur oak, red oak and jack oak, interspersed with basswood, wild cherry, honey locust and elm. The trees are from six to twelve inches in diameter and from thirty-five to forty feet in height. The stand is so dense that the smaller and weaker trees are being suppressed. By an examination of a large number of recently cut stumps the age of the trees was found to range from twenty-five to thirty-five years. Only one tree was found that contained forty annual rings. The age of the trees, the vigor of their growth, the complete absence of old stumps or other evidences of an older timber growth, all indicate recent forestation. Later this opinion was confirmed by an old settler, who stated that thirty-five years ago the slope supported a growth of prairie grass, dotted here and there with clumps of ground oak and hazel brush and an occasional small tree. At the present time the timber line extends to the crest of the ridge. The long, rocky, southern slope contains numerous clumps of hazel brush and ground oak. In these clumps vigorous young oak, elm, honey locust, and box-elder trees have obtained a foothold. Cattle and horses have ranged this land freely for years, but they do not seem to have interfered seriously with the timber growth. It seems to be but a question of a few years until

the forest area will extend across this slope also.

Another tract between two "draws" that converge at the timber line is being covered with a growth of white and red elm, green ash, black oak, bur oak, wild cherry and sycamore. In places as many as twelve or fifteen trees are found on a single square rod. In size they vary from mere sprouts to fifteen or twenty feet in height. In a few years the smaller trees and underbrush will be suppressed and true forest conditions will prevail. The forest area is being extended up this ridge a distance of forty rods beyond the timber line of fifteen years ago. At that time the tract was fairly well covered with a growth of hazel brush, ground oak and sumac. This tract has been browsed over continuously by horses and cattle (for the past eight years by sheep also) but they have not been able noticeably to check the timber growth.

Two miles farther downstream there is a tributary a couple of miles in length. It is skirted by a vigorous growth of young timber, in which oak and walnut predominate. At places the timber belt is fifteen to twenty rods in width. An old settler informed me that thirty-two years ago, when he took his claim, there were only a few scattering trees along the stream. From personal observations of the writer and from the testimony of old settlers, it seems beyond question that along the creek and its tributaries the forest area has increased several fold since the first settlements were made, about thirty-five years ago.

But it is not alone along the streams that the tendency to an increase of forest areas may be noted. On the home farm a lot of worthless plum trees were allowed to stand as a windbreak. They are being supplanted by box-elder, elm, and wild cherry.

On an adjoining section a small rocky knoll is enclosed in the corner of a cornfield. An old wagon trail, several cattle paths and a former haystack have killed the virgin sod at these places. Clumps of elm and honey locust have taken possession, and the trees have attained a height of twelve to fifteen feet.

More remarkable still are the condi-

tions that prevail along a steep, rocky hillside on the same section. The surface of the ground is liberally strewn with glacial boulders of quartzite, while in many places the rocky soil affords but a scanty foothold for the prairie sod. The land has been pastured for years. There are a number of old cattle paths and washed places. These have been taken possession of by white-elm, box-elder and honey-locust trees, while the sodded portion of the hill contains clumps of sumac and wild plum. The trees show evidence of severe browsing, but they seem destined to survive, as the crowns of many of them are now beyond the reach of stock. These instances suggest that the prairie sod has been an important factor in retarding the spread of forest trees.

For a distance of a mile there is an untrimmed hedge along the pasture referred to above. Between the hedge and the wagon track, there is a growth of sumac and wild plum. In this thicket has sprung a dense growth of elm, honey locust, box-elder, and wild cherry. A few of the trees have attained a height of twenty-five feet. From this they grade down to mere sprouts of a season's growth. In many cases these young trees are denser than a good stand of corn. While the timber growth has made unusual headway here, owing to the negligence of the land owner and the road overseer, there is a marked tendency for trees to spring up along the road side, fence rows and waste places everywhere. Even cultivated fields are not exempt from their attempts to obtain a foothold. I doubt whether it is possible to find a single farm in this section of the state that does not contain more or less evidence of the natural spreading of forest trees.

The forest conditions along Pony Creek that have been described somewhat in detail are not essentially different from those to be found along the other streams in the county. Personal observations have extended from the Missouri River westward to the Blue and southward to the Kansas River. In passing westward from the Missouri, there is a gradual restriction of forest areas and a decrease in the number of

species; but no feature of the forest conditions is more marked than the prevalence of young trees along the ravines and smaller streams, indicating a recent extension of the forest area.

From a comparison of the timber along the Missouri and Nemaha rivers with that of the smaller streams; from the comparatively rapid extension of forest

areas along these streams and the recent forestation of their tributaries; from the abundant spreading of forest trees along road sides, fence rows, and waste places everywhere, the evidence appears to be conclusive that in north-eastern Kansas the natural conditions are favorable to the rapid extension of forest areas.

FORESTRY AND IRRIGATION IN CONGRESS

A CALENDAR OF NATIONAL LEGISLATION PERTAINING TO
CONSERVATION OF OUR WOODS, WATERS, AND PUBLIC LANDS.

February 29.

In the House: By Mr. Rodey: A bill (H. R. 13206) to amend an act entitled "An act appropriating the receipts from the sale and disposal of public lands in certain states and territories to the construction of irrigation works for the reclamation of arid lands."

March 1.

The House disagreed to the amendments of the Senate to the bill (H. R. 11825) making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1905.

By Mr. Humphrey, of Washington: A bill (H. R. 13291) for the protection of game animals, birds, and fishes in the Olympic Forest Reserve, in the State of Washington.

March 7.

The following message and the accompanying report were received:

To the Senate and House of Representatives:

I submit herewith the preliminary report of the Public Lands Commission appointed by me October 22, 1903, to report upon the condition, operation, and effect of the present land laws and to recommend such changes as are needed to effect the largest practicable disposition of the public lands to actual settlers who will build permanent homes upon them, and to secure in permanence the fullest and most effective use of the resources of the public lands. The subject is one of such great importance and

great intricacy that it is impossible for the Commission to report in full thereon at this time. It is now ready, however, to suggest certain changes in the law as set forth in the accompanying report. I commend these suggestions to the favorable consideration of the Congress.

THEODORE ROOSEVELT.

WHITE HOUSE, *March 7, 1904.*

March 8.

In the House: By Mr. Lacey: A bill (H. R. 13631) to provide for the entry of agricultural lands within forest reserves.

Also a bill (H. R. 13632) to provide for the disposal of timber on public lands chiefly valuable for timber, and for other purposes.

Also a bill (H. R. 13633) to regulate the disposal of public lands released and excluded from public forest reservations.

March 9.

In the Senate: Mr. Fulton, from the Committee on Public Lands, reported adversely on the bill (S. 2993) to amend the first section of an act entitled "An act authorizing the citizens of Colorado, Nevada, and the territories to fell and remove timber on the public domain for mining and domestic purposes."

The bill (S. 2994) extending the privileges of the above mentioned act to citizens of Oregon, Washington, and California was reported without amendment.

In the House : A message from the Senate announced that, among others, the Senate had passed the bill (S. 3205) authorizing the Secretary of the Interior to acquire the title to lands within certain Indian reservations.

By Mr. Jenkins : A bill (H. R. 13673) to amend section 2 of chapter 426, U. S. Statutes at Large : "An act to authorize the President of the United States to cause certain lands heretofore withdrawn from market for reservoir purposes to be restored to the public domain subject to entry under the homestead law with certain restrictions," so that any isolated or disconnected tract or parcel thereof may be sold for not less than \$1.25 per acre.

March 10.

In the Senate : Mr. Hansbrough introduced a bill (S. 4916) to provide for the disposal of timber on public lands, and for other purposes.

March 12.

In the Senate : Mr. Warren introduced a bill (S. 5009) providing for the transfer of forest reserves from the Department of the Interior to the Department of Agriculture.

In the House : By Mr. Reeder : A bill (H. R. 13867) to amend the act providing for national irrigation, approved June 17, 1902.

March 14.

In the Senate : Mr. Quarles introduced a bill (S. 5054) to provide for the disposal of timber on public lands chiefly valuable for timber.

Mr. Warren introduced a bill (S. 5055) providing for the transfer of forest reserves from the Department of the Interior to the Department of Agriculture.

March 16.

In the House : By Mr. Stephens of Texas : A bill (H. R. 14050) to subject the mineral lands within Indian reservations to location, operation, and entry.

By Mr. Mondell : A bill (H. R. 14052) prohibiting the selection of timber lands in lieu of lands in forest reserves.

Also a bill (H. R. 14053) providing for the entry of agricultural lands within forest reserves.

March 17.

In the Senate : Mr. Hansbrough, from the Committee on Public Lands, reported favorably, with amendment, the bill (S. 5054) providing for the disposal of timber on public lands chiefly valuable for timber.

The amendment was concurred in and the bill passed.

Senate bills 370, 932, and 4916, relating to the same subject, were indefinitely postponed.

Mr. Dubois, from the Committee on Public Lands, reported, with amendment, the bill (S. 3165) amending section 3 of the act of June 5, 1900. The amendment was concurred in and the bill passed.

This bill condenses the present law, and in case a homestead entryman has made an entry which he has been compelled, through no fault of his own, to relinquish, and for the relinquishment of which he has received no consideration, it allows him to make a second entry. Under certain restrictions, a man who has entered less than a quarter section may enter enough additional contiguous land to make 160 acres.

March 21.

In the Senate : Mr. Hoar introduced, by request, a bill (S. 5126) to create a colonization bureau and to provide for advances to actual settlers on the public domain.

In the House : A letter from the Secretary of the Interior, transmitting, with favorable recommendation, the draft of a bill relating to the settlement of certain lands released from withdrawal for forest reserves, was referred to the Committee on Public Lands.

March 22.

In the Senate : Mr. Gibson introduced a bill (S. 5168) to repeal the desert land act and the commutation provision of the homestead act.

March 23.

In the Senate : Mr. Dietrich introduced a bill (S. 5207) to amend the homestead laws as to certain unappropriated lands in Nebraska, and to authorize the leasing of grazing lands therein.

In the House: By Mr. Reeder: A bill (H. R. 14374) to amend the act providing for national irrigation, approved June 17, 1902.

March 24.

In the Senate: Mr. Fulton, from the Committee on Public Lands, reported favorably the bill (S. 4622) amending section 2305 of the Revised Statutes, which was passed.

This bill extends the rights of a soldier or marine so as to give him credit for the time passed in military service in taking up an additional quantity of land to complete his homestead entry.

Mr. Cockrell introduced a bill (S. 5231) to amend the act entitled "An act appropriating the receipts from the sale and disposal of public lands in certain states and territories to the construction of irrigation works for the reclamation of arid lands."

March 25.

In the House: By Mr. Daniels: A bill (H. R. 14417) to provide for the appro-

priation of the waters of the Colorado River for irrigation purposes.

March 30.

In the Senate: Mr. Nelson, from the Committee on Public Lands, reported without amendment the bill (S. 4401) to grant to the State of Minnesota certain lands for forestry purposes.

Mr. Clark, of Wyoming, introduced a bill (S. 5319) providing for right of way for irrigation and other purposes upon the public lands and reservations.

March 31.

The joint committee of the two Houses appointed to arrange the existing disagreement upon the various appropriations for the Department of Agriculture submitted a report with recommendations.

By one of these recommendations, all of which were agreed to, the appropriation for the Bureau of Forestry was reduced from the figure allowed by the Senate (\$450,140) to \$425,140.

RECENT PUBLICATIONS.

Key to North American Birds: Containing a Concise Account of Every Species of Living and Fossil Bird at Present Known, from the Continent North of the Mexican and United States Boundary, Inclusive of Greenland and Lower California. By ELIOTT COUES, A. M., M. D., Ph. D. Fifth edition. Illustrated. Dana, Estes & Co., Boston.

There has recently been issued, in response to a very general demand among ornithologists, this fifth edition of the scientific masterpiece of the late Dr. Coues. In the nature of things, such a work can never be complete in every essential detail, for the ways of birds are, to a certain extent, past finding out. Dr. Coues himself supervised the issue of four editions of his great work, finding with the exhaustion of each print something to add to his previous writings on the vast subject. In his preface to the fourth edition, issued in 1887, he noted that the fruits of the "unparalleled activity" of the great numbers of workers then in the field were not sufficiently sound and ripe to warrant a recast of the "Key." He died in December, 1899, leaving the manuscript for this fifth edition finished, but in

such shape as to offer serious difficulties in the publication, lacking his supervision. The services of Mr. J. A. Farley were secured, and he has completed the task in a manner which the publishers believe would have been Dr. Coues' exact idea of a presentation of this crowning work of his life.

The work as thus prepared comprises two large volumes, with profuse, well-prepared illustrations. Mr. Fuertes' drawings, two being in color, add richly to the edition. It is appropriate that this great work, serving in its latest form as a monument to the scientist whose activities were so varied and so unremitting, should contain a memorial to him in fitting terms. This is supplied in the form of the address delivered November 13, 1900, at the eighteenth congress of the American Ornithologists' Union, Cambridge, Mass., by Prof. D. G. Elliot, who wrote from the viewpoint of one who had known Dr. Coues for nearly forty years most intimately, both as a scientist and as a man. Thus the work stands complete, a boon to bird-lovers and a gratification to those who were privileged to come within the circle of Dr. Coues' acquaintance, either personally or professionally.

FOREST FABLES.

HOW A BEAUTIFUL, IRIDESCENT DREAM OF WEALTH
WAS RUDELY SHATTERED BY THE DICTUM OF SCIENCE.

WE like to print little things now and then about the doings of the scientific manufacturers in the old country, who, with their marvelous instinct for utilizing "all the hog except the squeal," turn shavings into antiseptic dressings for wounds and make electric insulation out of tiny chips, which in this country would go into the refuse-burner.

You can imagine, then, how attractive the following paragraph appeared in the pages of the canny and dignified *Transactions of the Royal Scottish Arboricultural Society*:

"ALCOHOL FROM SAWDUST.—At the recent Congress of Applied Chemistry, held in Berlin, Simonson, of Christiania, described a method of utilizing sawdust in the production of alcohol, which the *Country Brewers' Gazette* prints. About two tons of sawdust are boiled with sulphuric acid for three hours, the liquid matter being then extracted by pressure, neutralized, and left to stand for 18 hours to cool and clarify, and then fermented for four or five days. The resulting alcohol is afterward distilled and rectified, and, making ample allowance for loss in the latter operation, the yield of spirit is said to be about 2½ quarts per cwt. of sawdust. Trials with the method on a manufacturing scale are claimed to have demonstrated the possibility of working at a profit and of opening up a new industry in timber-producing countries, where enormous quantities of sawdust are annually wasted."

Here seemed a treasure indeed. What good news for the struggling American sawmill man, who bought stumpage years ago at \$1.50 and now can get only \$27 per M for his lumber. Hope for the "fourth great industry of the United States" after all. With this, and the tariff properly adjusted so that the Canadians can't compete, there might be a chance to create a few brand new lumber baronies, to the everlasting glory of the Star Spangled Banner.

"Timber-producing countries where enormous quantities of sawdust are annually wasted." That's us (U. S.) without a doubt. Why, up in the Lake States they build their towns on top of old sawdust piles because there

wasn't any other place to put them near enough to the mills so the men could take their noon meal at home. They can't get rid of it except by burning it up, as it is against the law to throw it into the streams and the furnaces can only accommodate a limited number of tons per day.

Two and one-half quarts for every hundred pounds! Great Snakes! What sacred rage would not possess the souls of the veteran lumber-jacks to think how, all unwittingly, they had sent to the burners or the furnaces enough alcohol in the course of their lives to keep all the woodsmen of the country oblivious of worldly cares henceforward and forevermore.

And so the paragraph was carefully clipped and prepared for the March number of *FORESTRY AND IRRIGATION*.

But it came to pass that in the interests of good journalism the clipping was submitted to a certain wise man, the breath of whose nostrils is the reek of retort and test-tube.

And he, having examined, announced that he himself had made alcohol by that process some five and twenty years ago, and that in his learned opinion it would take considerably more sulphuric acid and labor than the alcohol would be worth. In other words, that the cherished process of Simonson, of Christiania, was not worth a tinker's dam for commercial purposes, supposing that the method was quoted correctly.

The bright air castles collapsed. The potential sawdust barons continue to shovel their jag-laden by-product under the boilers, and thank the Lord they don't have to buy coal.

The bibulous lumber-jack girds up his loins and walks ten miles to get his jug filled whenever he needs alcohol.

The world moves on in the old way, using alcohol made from starch, in spite of Simonson of Christiania.

The man who hoped to revolutionize American methods by publishing Simonson's process sits sobbing softly to himself and reflecting on the perfidy of things in general and of foreign notes in particular.

Only Carrie of Kansas smiles.

She: Darling, if you should ever leave me, I know that I would pine away!

He: Don't you think it would be better to try to spruce up?—*Princeton Tiger*.

Whereupon the fir flew. She gave him a sounding box upon the ear, exclaiming, "You wretch! No dogwood treat a woman thus!" The teak-ettle grazed his head as he fled, and she heard hemlock an intervening door.

PUBLISHER'S NOTE

Mr. F. A. La Roche, the American agent for the world-famous Darracq motor cars, is one of the most conspicuous figures in the motor world today. Besides his business acumen, which enables him to furnish, in the Darracq, 75 per cent of all imported cars sold in America, he is an expert motorist and has himself set a number of records. He was a conspicuous figure at the Ormond-Daytona races, and the cups he has won will fill a large-sized cabinet; but, more than a business

offer of \$10,000 for a reduplication of its chassis, which is the most perfect example of mechanism of its class which has ever been seen here.

The Darracq cars make records and win prizes, in the first place, and they lead in speed, strength, endurance, and general reliability. In touring, as in racing, the Darracq preponderates as a record holder, and thus has a value not alone in the specialized fields of speed or endurance, but in both, thus making it a general-utility machine of great worth. Of



MR. LA ROCHE IN THE DARRACQ RACER

man and motorist, he is an engineering expert and an inventor of note, many of the best improvements on gasoline motor engines being due to his skill.

Of course, a large and important part of Mr. La Roche's success with the "Darracq" is due to the superiority of the machine, which has created a sensation at all automobile shows on account of the excellence of its design and workmanship. In fact, there is a standing

eight possible chances in the Darracq class in Europe in 1903, the Darracq captured six world's records, and in the voiturette competitions were ahead of all others. In America these cars hold no less than twenty records. For a machine for any purpose, on account of the different models made, the Darracq cars should be suited to any one. The headquarters of the American Darracq Automobile Company are in New York.

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DRAWING MATERIALS SURVEYING INSTRUMENTS K. & E. MEASURING TAPES

Instruments for Forestry Work of approved design, in best quality, largely adopted by the United States Bureau of Forestry.

ALL OUR GOODS ARE WARRANTED

Our Separate Catalogue of this Line of Instruments Sent Free on Application.

Foresters and Inspectors Wanted for the Philippine Forestry Bureau

The salaries of Foresters, Assistant Foresters, Inspectors, and Assistant Inspectors range from \$1,200 to \$2,400 per year. Actual and necessary traveling expenses to and from the scene of field work are allowed, and while in the field one dollar gold per day is allowed for subsistence.

There are a number of vacancies in the different grades, and good men are urgently needed for this interesting and important work.

The work of the Foresters is, to a large extent technical; that of the Inspectors more administrative and less technical.

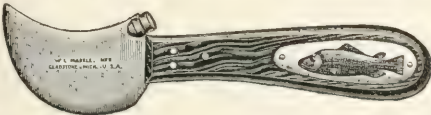
Examinations will be held in different parts of the United States about July 1 and November 1. For detailed information apply to the Bureau of Forestry, Washington, D. C., or to the Bureau of Insular Affairs, War Department, Washington, D. C.

Foresters and Inspectors now in the Philippine forest service and having from two to three and a half years' service, find the work very attractive, instructive, and healthful.

Copies of the Philippine Civil Service Manual may be obtained from the Bureau of Insular Affairs, War Department, Washington, D. C.

The reports, bulletins, and other publications of the Philippine Forestry Bureau should be read by all desiring to enter the service. Copies may be obtained by addressing the Forestry Bureau, Manila, P. I.

Marble's Fish Knives



Have a thumb rest which enables you to put the pressure in the right place when cutting off head and tail. The blades are of tempered tool steel.

This one is 2½ in. long and sells for 85c. We make two other styles. The handles are rosewood inlaid with German silver. You get a sheath free with each knife.



Automatic Gaff

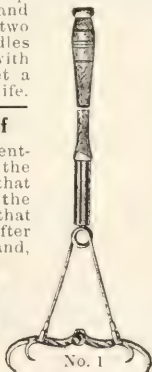
You merely reach out, gently touch the fish, and the Gaff closes with a grip that **HOLDS**. This means the saving of the big ones that have gotten away year after year. Used with one hand, opened with foot.

No. 1, for fish from 1 to 20 lbs. **\$1.50**

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Handles 30 inches.

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GROUP B.—2,000 acres yellow pine in Eldorado county; will cut 25,000 feet per acre, and 4,000 cords of wood on tract in addition; when cleared, the best deciduous fruit lands in the state. **Only \$6 per acre.**

GROUP C.—4,640 acres of redwood in Mendocino county, on line of railroad; will cut 40,000 feet per acre; also Oregon pine, not estimated. **\$20 per acre.**

GROUP D.—22,000 acres of redwood timber in Mendocino county; more than 400,000,000 feet now standing; railway to shipping point on ocean; this proposition includes mills in operation; capacity, 100,000 feet per day; net profits alleged to be \$75,000 to \$100,000 per annum. **Bargain at \$450,000.**

GROUP E.—12,000 acres redwood on Garcia River, Mendocino county; mill site and landing on ocean; will cut 40,000 feet per acre. **Price, \$25 per acre.**

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SHORTLEAF PINE.—12,000 acres. Will cut 7,000 feet of Shortleaf Pine per acre. Is directly on the Texas and Pacific R. R. Price, land and timber, **\$7.50 per acre.**

HARDWOOD.—6,300 acres near Washington, La., one-half mile from railroad. Will cut 8,000 feet per acre; 4,000 feet White Oak, then Red Oak, Gum, and Ash. Bordered by navigable river; soil alluvial and very rich. Price, **\$8 per acre.**

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LONGLEAF PINE.—22,000 acres on Gulf & Ship Island Railroad. Will cut 10,000 to 12,000 feet per acre. Price, **\$26 per acre.**

LONGLEAF PINE.—10,000 acres. Will cut 8,000 feet per acre. One-half has been turpintined. **\$9 per acre** for that which has been turpintined, **\$11 per acre** for that which has not.

HARDWOOD.—38,760 acres, lying between the Yazoo and Sunflower Rivers, both navigable and here only ten miles apart. The Yazoo & Mississippi Valley Railroad crosses one corner of the tract. This tract is claimed by timber experts to cut 7,000 feet per acre of the usual hardwoods of this locality—oak, hickory, gum, ash, etc. Price, **\$7.50 per acre.**

HARDWOOD.—6,000 acres within one mile of railroad. Estimated to cut 5,500 feet poplar, hickory, and white oak. Price, **\$9 per acre.**

HARDWOOD.—10,000 acres on new railroad. Estimated to cut 5,500 feet per acre, poplar and white oak. Land very rich, worth \$20 per acre for farming when timber is removed. Price, **\$11 per acre.**

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HARDWOOD.—100,000 acres hardwood on Yazoo & Mississippi Valley Railroad and Sunflower River. Virgin forest—oak, ash, gum, and cypress. Will cut 9,000 feet per acre. Price, **\$10 per acre.**

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HARDWOOD.—20,000 acres of hardwood in Macon county. Will cut 8,000 feet. Six miles from railroad, now being built. Price, **\$5.00 per acre.**

NORTH CAROLINA—Continued

HARDWOOD.—12,000 acres. Virgin forest of poplar, white oak, red and chestnut oak, hemlock, and some white pine. $1\frac{1}{2}$ cords tan bark per acre. This property is at present 14 miles from the railroad, but the Southern Railroad is now building a branch which will pass through this tract. Will cut from 12,000 to 15,000 feet per acre, on a conservative estimate. **Price, \$7.50 per acre.**

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GROUP B.—22,000 acres, estimated to cut 80,000,000 feet of choice cypress, 70,000,000 choice short-leaf North Carolina pine, balance of timber oak, ash, hickory, sycamore, gum, etc.

GROUP C.—14,000 acres, estimated to cut 30,000,000 feet of choice cypress, 15,000,000 of oak, 15,000,000 short-leaf pine, 8,000,000 cottonwood, 10,000,000 ash, balance hickory, sycamore, elm, gum, etc. If the above tracts are purchased outright the timber will cost less than one dollar per thousand.

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COAL LANDS.—10,000 acres coal lands, convenient to railroads; three veins, one $4\frac{1}{2}$ feet thick, and without slate. Cheap. Send for particulars.

WEST VIRGINIA—Continued

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1,500 acres spruce and hemlock, 2 miles from railroad; will cut 25,000 feet per acre. **\$37 per acre**

54,000,000 feet fine timber, on tract of 5,500 acres on Greenbriar River and C. & O. R.R.; will cut 20,000,000 hemlock, 10,000,000 white oak, 7,000,000 red oak, 8,000,000 chestnut oak, 1,000,000 white pine, and 8,000,000 poplar, birch, chestnut, linden, hickory, locust, etc. Profits on tan bark alone will pay for the land. **\$18 per acre.**

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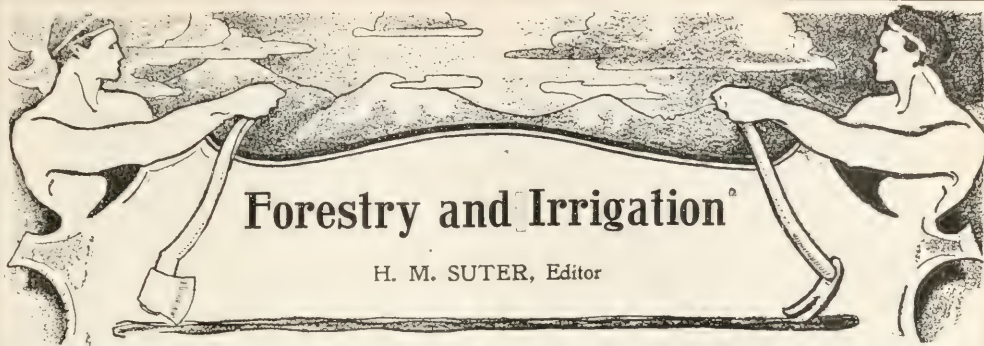
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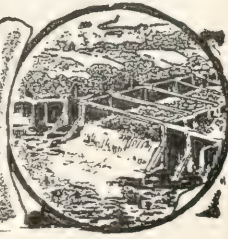
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NEWS AND NOTES.

Notice to Subscribers.

All subscribers to FORESTRY AND IRRIGATION who fail to receive their copies by the fifteenth of the month should notify this office at once. We frequently get complaints from subscribers three or four months after the publication of a certain number, stating that they had failed to receive their copies. Under such circumstances we can not promise to supply the missing numbers. Failure to receive the magazine in many cases is due to subscribers not notifying this office promptly of changes of address. Another matter that should be noted by subscribers is that where they expect their magazine to be forwarded from one post-office to another, postage must be left for this purpose, as required by law, otherwise the postal authorities will not forward it.

The Association Year Book.

The year book of the American Forestry Association for 1904 was sent out to all members several weeks ago. Any one who has failed to receive a copy should at once notify the Secretary, Mr. Edward A. Bowers, P. O. Box 346, New Haven, Conn. We beg to call special attention to the cards which were enclosed in each book and to urge members of the Association to obtain the signature of a new member on the same, and send to the Secretary. Each member should be able to secure at least one new member, and this plan, if carried out, would strengthen the Association tremendously. Kindly lend a hand to forward the movement.

Members will greatly facilitate the work of the officers of the Association and prevent confusion if they will promptly report any errors in their

names or addresses as shown in the year book. The Association has been put to considerable expense and trouble in getting out this book and in trying to keep an accurate list of its members. The coöperation of all is therefore earnestly requested.



In Congress.

What Congress did for the forest interests of the country at the session just ended can be summarized in two words—it dodged. In addition to the usual lot of relatively unimportant bills affecting the forests of the United States, there were three before Congress that were of the first importance and in which the American Forestry Association, as an organization, was deeply interested. These were: The transfer of the administration of the federal forest reserves to the Department of Agriculture, in order to combine all government forest work in the Bureau of Forestry, where it properly belongs; the repeal of the Timber and Stone act, which has been agitated for years, and, finally, a bill calling for an appropriation of \$50,000 for the building of roads and trails in the federal forest reserves.

The first two of these measures are familiar to all readers of this magazine, as they have been backed by the American Forestry Association for several years. The third was taken up this winter by Mr. Bowers, Secretary of the Association, in compliance with a resolution passed by the Association at its last annual meeting. This resolution called for an appropriation of \$500,000 by Congress to be expended in the making of roads and trails in the federal forest reserves. Such a move, it was felt, would result in immense improve-

ment in the general administration of the reserves. These roads and trails would be of the greatest service in fighting forest fires.

Mr. Bowers suggested that Congress be asked for only \$50,000 for this purpose, to be available during the coming fiscal year, the idea being that Congress might not be willing to make such a large appropriation at the present time as the resolution called for. His suggestion met with the hearty approval of Secretary Wilson, of the Department of Agriculture, who referred it to the Secretary of the Interior for action. Secretary Hitchcock approved the matter, and it was forwarded, through the Treasury Department, to the Committee on Appropriations.

All this was incorporated in Senate Document 273, copies of which were sent to all the vice-presidents of the Association.

Congress took no action on this matter, nor on any of the others, beyond postponing further consideration of them until some future time. It picked about the edges a little, but the general air of "do-nothing-at-this-session" that hovered over the capitol was too much for the efforts of those who interested themselves in trying to push these measures to a successful issue.

However, the Association has met defeat frequently in the past before finally gaining its point. There should be no let-up between now and the opening of the next session. Let your Senators and Representatives know your opinions on these matters. They will be taken up again promptly with the opening of the next Congress.

Planting a Tie Forest. Under the direction of State Forestry Commissioner Rothrock, the work of planting 50,000 additional locust trees for the Pennsylvania Railroad at Conewago has begun.

The first 50,000 trees, which were planted last fall, are now being trimmed. A month will be required to finish the work.

Next fall the railroad company will plant 200,000 trees, and the following

spring 600,000 trees. Two thousand acres of land will be required, and a tract of land one mile wide and three miles long will be covered. In the course of twenty years the company expects to get 5,000,000 cross-ties from this vast forest.



Forest Fires in New Jersey. In the annual report of the state geologist there appear some interesting facts about the forest fires which occurred in New Jersey during 1903. F. R. Meier, who acted as consulting forester to the survey, made an investigation of the subject. Owing to the severe drought which prevailed in April and May, there were numerous and extensive fires in various parts of the state. Mr. Meier's examinations show that seventy-nine forest fires occurred in the state. The total of acres burned was 85,046. Compared with 1902, there were fourteen more fires, but the burned tracts measured 13,804 acres less. The damage, however, was much greater, aggregating \$305,744.50, as against \$168,323 in 1902, an increase of about 82 per cent. This great increase in the loss is due in part to the fierceness of the fires, and also to the better class of timber burned.

As to the causes of these fires, the investigation showed that locomotives started twenty-six; persons burning brush or grass, twenty-one; smokers, seven; children, six; incendiary, three, and the balance originated from a variety of causes. The negligence of persons in burning brush resulted in the destruction of 49,197 acres and did damage to the extent of \$169,494, the loss from one fire alone in Burlington county being \$105,000. Those set by locomotives caused a loss of \$79,658 and covered 19,521 acres. These figures are interesting, inasmuch as, in the popular mind at least, the railroad is supposed to be the chief, if not almost the only, cause of forest fires. While it is true that many fires have been started by sparks from the locomotives, yet during the past season only one-third of the fires in New Jersey originated in this way, and these caused only about one-fourth of the loss. Negligence in burn-

ing brush and grass, particularly on windy days, started one-fourth of the fires, burned nearly 60 per cent of the total acreage, and did more than 50 per cent of the damage. In view of these facts, it is evident that there is need for a more rigid enforcement of the law in reference to forest fires, particularly of those provisions which forbid the burning of brush, grass, etc., without maintaining a sufficient watch to prevent it spreading.

Atlantic county suffered the most from forest fires in 1903. Nearly 25,000 acres of timber were swept off, and the loss figured up \$75,205.

Union county had one fire. Three acres were burned over, and the loss was estimated at only \$1.50.



California Water and Forest Association. A special meeting of the California Water and Forest Association was held Saturday, April

23, in the Chamber of Commerce rooms at 307 Sansome street, President W. H. Beatty in the chair, to elect officers for the ensuing year and consider the reports of various men who have been in the field. A delegation of the Outdoor Art League appeared before the association asking for coöperation in saving the Calaveras big trees to government ownership.

Among the reports read was one by E. T. Perkins, of the United States Geological Survey, on the Colorado River and its Possibilities; by H. E. Greene, of Los Angeles, on the Sacramento and its Tributaries; by J. A. C. Clausen, of the United States Reclamation Bureau, on the Inyo, and by Professor Samuel Fortier, of the State University Department of Agriculture, on Irrigation and Agriculture. A paper by Gifford Pinchot, of the Forestry Department, on Special Phases of Forestry in California, was also read.

For the Outdoor Art League Mrs. Lovell White appeared with a large committee of ladies. They read a letter from Secretary Wilson stating that he would be glad to seek a practicable plan of saving the Calaveras big trees to the government, and asked the asso-

ciation to indorse their plan of having a joint federal and state board to appraise these trees for future purchase or condemnation by the United States. The association agreed to this, and passed resolutions indorsing the plan and requesting the Department of the Interior to arrange some way in which this could be done.

Other interesting and valuable papers besides those mentioned, were read at the afternoon session, and the government was asked to continue its present plan of testing timber in California. At the election of officers all the old officers were reëlected, Charles Laton being chosen on the advisory board, vice W. E. Smythe, resigned. President William H. Beatty announced that the next meeting would be the regular one in December, and late in the afternoon the association adjourned till that day.

In a discussion during the session of proposed legislation on water rights it developed that the association was divided on its expediency, President Beatty deprecating any attempt at change and Judge John D. Works, of Los Angeles, favoring a revision of present laws.



Forest Fire Record. With the advance of spring and summer come notices of forest fires of

a minor degree of destructiveness as yet, but gradually growing more and more disastrous as the season of their destructiveness reaches its height. The most serious fire so far this season has been raging in the Sierra Madre Mountains of Mexico, about 150 miles from El Paso, Texas. The fire started about a week ago, and has since traversed an area covering many miles, in places sweeping the hills clean of valuable timber in the game and forest preserve country. Second in point of destructiveness were the fires which have been consuming valuable timber in the Pine Mountain district of Kentucky. Forest fires of more or less disastrous degree have been prevalent during the entire month in many sections of North Carolina. Much valuable standing timber and 800 cords of lumber were destroyed

in a fire which broke out on April 22 in Dinwiddie county, Virginia, in the vicinity of Ford's depot, on the Norfolk and Western Railroad.



William M. Canby Dies. By the recent death of Mr. William M. Canby the American Forestry

Association loses one of its most valuable members. He was for several years vice-president for the State of Delaware, and at all times took a great interest in the work of the association. Mr. Canby was one of Delaware's foremost citizens, prominent in business and in many charities. He always took a deep interest in outdoor life, and was president of the Delaware Field Club for a number of years. He was trustee of the fund set apart by his friend, Professor Asa Gray, the famous botanist, for the promotion of the study of botany in this country.

Sargent's *Silva of North America* says concerning Mr. Canby :

"*Crataegus canbya* grows in hedges and thickets in the neighborhood of Wilmington, Delaware, where it was first noticed in October, 1898, by Mr. William M. Canby, and on the shores of Chesapeake Bay in Cecil county, Maryland. It grows also in the meadows of Tohickon Creek at Quakerstown, Pennsylvania, and on Tenicum Island, at Haddington, and Gray's Ferry, Philadelphia."

He acquired a taste for botany early in life from relatives and afterward in school. Since 1858, when he visited Florida for the first time in search of plants, he had been an active and assiduous collector in many parts of the United States during long and frequent journeys, and his specimens, which have been distributed with a lavish hand, are found in all the large herbaria of the world. His own herbarium of about 30,000 specimens, the harvest of many years of work in the field, supplemented by liberal purchases and by exchanges, having outgrown the space at its disposal, is now in possession of the College of Pharmacy of New York. Since 1893 Mr. Canby had been engaged in forming an herbarium for the Natural His-

tory Society of Delaware, which now contains about 13,000 species. Canby, a genus of delicate and interesting annual plants of the poppy family, natives of the deserts of the West, dedicated to him by his friend, Asa Gray, will recall to botanists the name of Canby and his important and unselfish labors in indorsing the knowledge of the American flora.



Kansas Meeting. The twentieth semi-annual meeting of the Kansas State Horticultural Society, to be held at Dodge City, Kansas, on May 11 and 12, will have a number of features which should prove instructive and valuable to those interested in forestry and irrigation in Kansas. Several representatives of the Bureau of Forestry will be present and read papers on various phases of forestry in Kansas and elsewhere, and several other prominent speakers will talk on irrigation and its application in various fields of agriculture. The program for the two days' session contains the following addresses on forestry and irrigation :

"Report of Work and Conditions of the State Forestry Station," Hon. Robert M. Wright, State Forestry Commissioner ; "Work of the United States Bureau of Forestry in Kansas," William L. Hall, Bureau of Forestry ; "Report on Irrigation in Western Kansas," I. L. Diesem, Garden City ; "Forestry as Applied to the Development of Kansas," Geo. W. Tincher, Morris county ; "Commercial Forestry: Catalpa Culture as an Investment ;" "Shelter Belts and Windbreaks," Dr. G. Bohrer, Rice county ; "Trials of Fruit Growing in the Semi-arid Region," Nicholas Mayrath, Dodge City ; "The Hope of the Semi-arid Region," Hon. F. Dumont Smith, State Senator, Edwards county ; "Need of Forest Culture," Representative Victor Murdock ; "Progress of Forestry in United States," with stereopticon views, etc., William L. Hall, Bureau of Forestry ; "Fruit Growing with Irrigation," C. H. Longstreth, Lakin, Kearny county ; "Forestry Planting in Western Kansas," R. S. Kellogg, Bureau of Forestry ;

"Commercial Fruit and Vegetable Growing with Irrigation," Hon. J. H. Crowley, State Senator, Rocky Ford, Colorado ; "The Reclamation Law and its Application," M. C. Hinderlider, engineer, U. S. Geological Survey ; "Insect Enemies of Kansas Trees," Prof. E. A. Popenoe, Chair of Entomology, Kansas State Agricultural College ; "Forestry in its Relation to Climate," Prof. I. D. Graham, associate editor of *Kansas Farmer* ; "What I Know About Trees," Joseph Mellechor, Ford county ; "Woodlot for the Kansas Farmer," R. S. Kellogg, Bureau of Forestry.



Michigan Appoints State Forester. Wesley Bradfield, a student of forestry in the senior class of the University of Michigan, has been appointed forester by the Michigan State Forestry Commission. He will serve on the state forest reserve in Roscommon county. Fifty thousand white pine seedlings have been purchased and will be set out on the reserve this spring ; and in addition seed will be sown to furnish the state with its own plants after this year and next.



General Reclamation Notes. Engineer C. H. Fitch has been directed by the Chief Engineer of the Reclamation Service to take charge of the work of that bureau in South Dakota and adjacent areas. The most important piece of work under Mr. Fitch's charge this season will be the completion of the surveys and the beginning of construction, if found feasible, on the Bellefourche project.

Mr. Raymond F. Walter will be continued in charge of the investigation and surveys on this project, occupying a position analogous to that of constructing engineer. Mr. Fitch will have general supervision also of surveys and reconnaissance on the Big Horn project on Crow Indian Reservation, on the Fort Buford project in North Dakota, preliminary surveys on the Bitterroot project, the Lake Basin project, the Sun River project in Montana, and the surveys of New Fork and Green River project in Wyoming.

A competent engineer will be sent soon into western Montana to make a general examination of the opportunities of reclamation, particularly of the character of land ownership, and ascertain the views of the persons owning reclaimable lands regarding the construction of an irrigation work thereon by the government.

With the passage of the Crow Indian bill the Reclamation Service will start a field party at work making a thorough investigation of the possibility and feasibility of a comprehensive irrigation system for the lands thrown open for settlement on this reservation.

Citizens in the Lower Yellowstone valley are showing commendable interest in the plans of the government for the construction of what is known as the Fort Buford irrigation project. Numerous letters have been received from organizations and citizens in the valley urging upon the government the continuance of its work in that section, and indicating that the land owners are generally approving the project and will coöperate with the government in every way to insure its success.

Congressman Dixon has presented numerous petitions and in person has urged the continuance of the work. The Northern Pacific Railroad Company, which owns some land in this valley, has agreed to coöperate with the government to the fullest extent, and will dispose of such tracts as are under the proposed canal, under regulations of the Reclamation Act, to *bona fide* settlers only.



Agricultural Land in Forest Reserves. In the creation of forest reserves it frequently happens that small parks or open valleys in the mountains are included, and that these are desired by individuals for stock ranches, or for cutting wild hay, or for similar agricultural purposes. The argument is made that such agricultural lands should be excluded from the forest reserves, and that the boundaries should be drawn along the narrow valleys extending up into the mountains.

As a general proposition, it is agreed that agricultural lands should be ex-



HON. ELON R. BROWN,

STATE SENATOR FROM THE THIRTY-FIFTH NEW YORK DISTRICT.

Senator Brown has been conspicuously active in the legislature this year in forwarding measures looking to the welfare of New York forests.

cluded from forest reserves, but there is a side to the question which is frequently overlooked by those advocating the exclusion of such lands. As a rule, these areas are at high altitudes and are useful mainly for producing wild hay. The little mountain streams can readily be diverted upon these lands, the water spread over the surface, and forage crops obtained.

Some of the water thus applied finally returns to the stream by percolation, and serves to maintain the summer flow, but from one-half to two-thirds of it is lost by evaporation, and the little tributaries which swell the main stream are practically cut off. In case of a river whose flow is entirely appropriated for the use of lands in the lower valleys, this results in very serious losses. For every acre of

wild hay irrigated in the mountains, there is lost the higher-priced product of an acre of far better land in the valley.

This condition is being gradually recognized, and less weight is given to the cry of those who would exclude all agricultural lands from the forest reserves. The streams of the arid region have far greater value in the development of the low-lying lands in the broad valleys at the foot of the mountains, and their waters should be conserved in every possible way, not merely to protect the prior rights, but because such lands have greater economic value to the whole country.

The officers in charge of the designation of boundaries of forest reserves must bear in mind these conditions and give less heed to the demands for exclusion of these high agricultural lands, if by so doing they will jeopardize the rights and needs of the better lands at the foot of the mountains.



Selecting Supervising Engineers.

The public has only just begun to appreciate the stupendous character of the work of the Reclamation Service in the construction of some of the largest dams and canals in the world. Difficult problems of construction confront the engineers, problems involving new and unsolved questions and presenting physical features as yet little understood.

Manifestly only engineers of broad training and wide experience in actual construction in the West are competent to supervise and direct these great works. The selection of the supervising engineers of the service, whose entire attention must be devoted to the important work of construction, is being made with particular care, after full consideration of all the requirements. These engineers must supervise the district engineers and see to it that each is provided with necessary advice and assistance from the consulting engineers. It is appreciated that no man could cover the whole ground and do justice to the important work, and therefore a number of supervising engineers are employed, the territory of each being designated

in accordance with the needs of the service.

For California and adjacent areas Mr. J. B. Lippincott, of Los Angeles, California, is the supervising engineer. He has had wide experience in matters pertaining to planning and the construction of systems of water supply, and is thoroughly familiar with the conditions prevailing upon the Pacific coast, having been consulting engineer in a number of important projects.

For the Northwest in general the supervising engineer is Mr. Hiram N. Savage, formerly of southern California. Mr. Savage has had to do with the construction of the largest dams built for water storage for irrigation in the United States.

For Arizona and adjacent areas the supervising engineer is Mr. Arthur P. Davis, whose name is familiar throughout the West. Mr. Davis designed the principal works for the great storage reservoir on Salt River, Arizona, ranking among the foremost of such works in the world.

Other supervising engineers are being provided as necessity arises, the sphere of control of each being adjusted so that no one man may be overloaded with the engineering details.

The various engineers and assistants are selected and assigned to duty in accordance with their skill and experience, and after careful study of the necessity for each man given by the supervising and consulting engineers. Great care is taken to see that no more men are employed in the Reclamation Service than are actually needed for present examination and for future construction.

By providing these safeguards and distributing the responsibilities among well-known and efficient engineers, it is believed that the deserved confidence of the people and of Congress can be retained and the best results secured at the least possible outlay. Chief Engineer Newell's care along this line is typical of his handling of the reclamation work from its inception. The result is that the work has gone forward rapidly and effectively, thereby disappointing the various critics who at the

beginning were so ready to predict failure for this important public service. The farther it goes the more thoroughly we are convinced that it is in the right hands.



**To Examine
Yakima
Valley.**

District Engineer T. A. Noble, of the Reclamation Service, at Spokane, Washington, has been

instructed to proceed to make the necessary investigations at the earliest possible date concerning the development of the Yakima Valley, to ascertain whether the opportunities for irrigation works there are of such a character as to warrant the beginning of a large government work in this valley.

The investigation will be for the purpose largely of securing a better knowledge of the physical conditions of this region. The Department at this time is not fully informed as to the extent to which development may be carried, the general location of the irrigable lands, or the character of the ownership of these lands, whether public or private.



**Looking to
Oregon's
Greatness.**

The Chief Engineer of the Reclamation Service has received an interesting letter from Mr.

F. M. Chrisman, of Silver Lake, Oregon, describing the numerous natural advantages of the Northern Lake country and urging its early consideration by the engineers of the service.

Mr. Chrisman describes this region as one of unusual attractions and presenting numerous favorable sites for the construction of irrigation works. He calls attention to the fact that the water of Summit Lake, Davis Lake, and the upper waters of East and West Deschutes can be readily diverted to a very large area in that section of the state. He believes each of these lakes can be readily formed into a large storage reservoir, furnishing an ample supply for the irrigable lands under them.

According to Mr. Chrisman, the benefit derived from such a government work would be to make homes for at least 10,000 people, and make productive an immense area of arid land now

practically worthless. As the lands of the proposed forest reserve in this region are to be definitely settled this summer, he deems it advisable that a preliminary investigation should be made at once in connection with the forestry work. Mr. Chrisman believes that under the impetus of a government work the Northern Lake region would be the center of the whole state in the near future. It is a natural alfalfa country wherever water can be placed on the sage brush plains. Barley and oats yield abundantly when irrigated, and the growing of fruit has proved successful.

An investigation will be made early this season by the government engineers to determine the feasibility of constructing a large irrigation work there.



In Oklahoma. In the furtherance of its promise to thoroughly investigate the possibility and feasibility of government irrigation works in Oklahoma, the Reclamation Service has ordered Hydrographer Russell to establish gaging stations in the western part of the territory, at Kenton, Beaver City, and such other points in that vicinity as are best suited for the purpose on the Cimarron and Beaver rivers.



**Gift to Forest
School.**

The University of Michigan has received from Mr. Arthur Hill, of Saginaw, one of its regents, a deed to 80 acres of land near Ann Arbor, the tract to be known as the Saginaw Forest Farm. Besides being admirably adapted to seedbed, nursery, and model plantation work, the farm contains a small lake well suited to furnish the water required by the University, should this ever become desirable or necessary. It is intended that work shall begin on the farm during the coming spring. This beginning effort will include: (1) The planting of a considerable variety of trees in order to test their adaptability to this region. (2) The starting of a number of seedbeds to demonstrate seedbed methods to the classes in silviculture, and also to serve as object lessons to the many visitors interested in

forest improvement. (3) A number of model plantations of both conifers and hardwoods to serve as demonstration areas for the students. Upon these areas will be shown the results of various methods of planting, as well as more advanced silvicultural operations, such as cutting the hardwoods at the end of their first, second, or third year in order to discover the best time to set them to sprout for post and pole timber.

The tract contains a great variety of soils and topography, including good wheat land, poor gravel, and gullied soils, and for this reason it is one of the best adapted locations which can be found anywhere in this vicinity for the purpose in view.

Inasmuch as a large part of Michigan's forestry work must of necessity consist of the re-establishment of the forest rather than the care of existing woodlands, the Forest Department of the University, and with it the whole State of Michigan, is to be congratulated on this admirable and timely gift by one of its most liberal and thoughtful men. This generous gift might well be imitated by others in Michigan, as well as elsewhere. Large areas of waste lands have reverted for taxes or are otherwise useless to their owners. Why not turn them over to some safe institution for forestry purposes, and thus have them render the double service of growing valuable material and at the same time of assisting education in a direction so much needed at the present time?

Mr. Hill is an indefatigable worker in the interests of forestry, especially with a view to improving conditions in his own State of Michigan. He has for several years been rendering most valuable service as a member of the Michigan State Forestry Commission and the American Forestry Association.



Hydro-Economic Studies.

A forthcoming report of the United States Geological Survey will contain valuable data concerning

the use of water in the manufacture of paper.

The strawboard investigations show

that the relation of strawboard waste to water supply is particularly strained in the States of Ohio, Indiana, and Illinois. The object of the investigation made by the survey in Indiana was to bring the strawboard company to a realization of the fact that the enormous waste of the valuable cellulose which is carried away and causes trouble is unnecessary, and that pollution by strawboard waste can be removed if the method of strawboard manufacture is changed. The valuable materials which are now carried away in waste waters to the pollution of the streams may be retained and converted into strawboard.



Not Unusual for Oregon.

The World's Fair Commissioners for the State of Oregon have secured a large fir log from Clatsop county. It is by no means an unusually large tree, although it measures nine feet in diameter at the butt. The section sent is 28 feet in length, scales 12,000 feet of lumber, and weighs 46,750 pounds. The tree was 431 years old and measured 200 feet to the first limb.



Important Experiment Station.

The United States Department of Agriculture has decided to establish a Plant Introduction Garden and Experiment Station at Chico, California. Contracts for the necessary land have been closed and work has been begun on what will undoubtedly be the greatest institution of its kind in America and perhaps in the world. A beginning will be made with ninety acres, but it is the intention of the department to extend the area as the needs of the institution require. The garden will be devoted to experimental culture of the plants introduced from various parts of the world, and to a careful study of plant life.

Such an institution has long been contemplated by the Department of Agriculture. California was selected for its location on account of climatic conditions, which admit of the culture of tender plants from the tropics and of northern products as well. The ideal

location for such an institution is that which admits of the successful cultivation of the widest possible range of products, and the commission intrusted with the duty of selecting the site believe they have found it at Chico.

This commission was composed of Prof. P. H. Dorsett, government expert, who will have charge of the institution, and Prof. A. V. Stubenrauch, of the University of California. They spent months in making a careful study of conditions affecting plant life in various portions of the state, visiting and carefully inspecting each locality likely to prove available. The decision in favor of Chico was reached sometime ago, but the site selected could not be secured and another tract had to be chosen, which has now been done and the purchase consummated.

Chico is situated near the eastern border of the great Sacramento Valley, 75 miles north of Sacramento, the state capital, and was the most northerly point considered by the commission. Climatic conditions in California are affected but little, if at all, by conditions of latitude, the orange, the lemon, and the olive being staple products of a district that measures fully 500 miles north and south.

California Hydrography. The stream-gaging work of the U. S. Geological Survey, in cooperation with the State of California, is under the charge of Mr. S. G. Bennett, engineer, whose headquarters are in the Rialto Building, San Francisco. Between forty and fifty river stations are being maintained and daily records of flow kept. These extend from the Oregon line to Mexico, and cover all the principal streams of the state. In addition, an extended series of low-water measurements of the mountain tributaries or streams is made annually.

During the past year a publication entitled "California Hydrography" has been issued by the Geological Survey. This contains 500 pages of closely tabulated records of stream flow observed in the State of California, and contains not only the records of the Geological

Survey, but all of the data that is available from any other source bearing on this subject. It also contains records of the evaporation, floods, discharge, etc. The rainfall in the higher mountains of California is given particular consideration, and records of rainfall stations at elevations above 1,000 feet are presented, together with a map showing the estimated position of the rain curves of the state.



Public Service. Apropos of a bill that was before Congress this winter asking for an appropriation of one million dollars to be used in the erection of a building for the United States Geological Survey, some ill-informed newspaper correspondent has been lamenting the extravagance of Director Walcott in appointing Mr. George F. Kunz to be "Radium Commissioner" at the Louisiana Purchase Exposition. His lamentations have so reverberated through the country press that it seems only fair to Director Walcott, Mr. Kunz, and the public to explain that Mr. Kunz is giving his services as a radium expert to the Survey and the nation without any expectation of reward except that which may come to him with the consciousness of good citizenship. It behooves the critics to inquire first whether they may not be maligning their own benefactors before they begin to rail at officials for appointing "commissioners to exploit solium, the X-ray, liquid air, bottled sunshine, paleontology, and balloonacy."

Even a million-dollar building is not the extravagance it may seem to be. The twenty-fourth annual report of the Director of the Survey shows that the Survey was obliged to expend the considerable sum of \$28,400 for office rent during the fiscal year from July 1, 1902, to July 1, 1903. One does not need to be an expert bank accountant to calculate that under the operation of the principles of compound interest the government might to-day be the richer by the value of its building had it erected a million dollar structure for the use of the Survey when that bureau was first established, a quarter of a century ago.



DR. JOSEPH TRIMBLE ROTHROCK,
COMMISSIONER OF FORESTRY FOR PENNSYLVANIA.

PENNSYLVANIA is the first of our states to adopt and put in operation a rational forest policy. The people and the law-making body of the state are thoroughly in sympathy with the idea and act in unison. This highly desirable state of affairs is in a great measure due to the ability, tact, and great public spirit of Dr. Joseph T. Rothrock, who has been Commissioner of Forestry since the creation of that office. He has devoted himself unselfishly to this great work, and the best evidence of his success is the general confidence he has won from the public and the free hand he is given in forest matters by the state authorities. Dr. Rothrock was born at McVeytown, Pa., on April 9, 1839. He graduated at Harvard with the degree of Bachelor of Science in 1864, and received the degree of Doctor of Medicine at the University of Pennsylvania in 1867. Dr. Rothrock was captain of Company E, 20th Pennsylvania Cavalry, during the Civil War, and was wounded at Fredericksburg. In 1877 he was appointed Professor of Botany at the University of Pennsylvania. He is the author of "Vacation Cruisings," "Botany of the Wheeler Expedition," "Flora of Alaska," "Revision of North American Guarineæ," Proceedings of the American Academy; and Pennsylvania Forestry Reports, 1895, 1896, 1897. He has from the first been one of the most active promoters of the Pennsylvania Forestry Association, which organization includes in its membership several thousand of the most public-spirited citizens of the state, and which has been a great factor in moulding public opinion in connection with forest matters.

THE AMERICAN FORESTER AT WORK.

A NEWCOMER IN OUR NATIONAL LIFE WHO
HAS ONE OF THE MOST VITAL INTERNAL
PROBLEMS OF THE COUNTRY TO SOLVE.

BY

ROBERT V. R. REYNOLDS.

THE forester is a newcomer in the field of American workers. Although a number of articles with regard to his work have been published from time to time, the majority of people across the country have as yet only vague ideas in regard to the qualifications required for satisfactory performance of his duties, or what he actually does when in the field.

The need of men thoroughly trained and competent to handle the problems of this new profession has been realized in America for only a few years, and it has found Americans very meagerly prepared to take up the heavy task of properly handling their forests with regard to the necessities of the present and coming generations. With only one or two exceptions, the men who stand in the first class today have been trained abroad, and can be counted on the fingers of both hands. Next to them in preparation we find perhaps sixty men who have had considerable training in American schools and several years' experience under the guidance of the men first mentioned. There are as many more who have had either the training or the experience, but not both. Finally, there is a number of well-educated men who have a smattering of the subject gained through slight experience and reading. Altogether, the really useful men count up to little more than 200 in the states and the Philippines.

The requirements are severe. As in other kinds of engineering, a man may do good work in the schools and be worth very little until he has had experience, or else upon taking up practical work he may prove to be lacking in the requisite push or stamina, or those essential qualities which alone can put theory into practice.

There are at least five qualifications which are valuable to a man who takes up this profession, intending to make it a thorough success in future years, taking into consideration the competition which is about to commence.

First. He should be of sound body, fair habit of health, and temperate, otherwise the exposure, fatigue, and privations which he is very likely to encounter will bring his activities to an untimely end.

Second. He should be a college graduate.

Third. He should be a graduate of a forest school.

Fourth. He should have the widest possible experience, at least in temperate regions, including a tour of inspection through the instructive forests of Germany and other progressive European countries.

Fifth. He *must* have good, practical common sense, or all the rest is worth but little.

While it is not practicable to insist upon all these qualifications at present, there is little doubt that they will some day be much more rigidly demanded than now. In fact, the signs of the times already indicate such a state of affairs, especially in the government service.

A very large majority of American foresters are in the government service. The Bureau of Forestry of the U. S. Department of Agriculture has been the training school which has developed a great many useful men by the drill of practical work. The forest schools recently established have contributed much to the personnel of the Bureau, but can not give that final test of actual service which alone can determine a man's value and make him efficient and self-reliant.

Under these conditions it is very natural that the forest schools have acted to a large extent as feeders for the government service, and have patterned their courses according to the needs of the Bureau as developed in actual service all over the United States, and it follows that with a few exceptions the Bureau operations hereinafter described are typical of similar work as carried on by all foresters in the country.

The European forester, with centuries of precedent to guide him, is at a great

The European's very weight of learning would militate against him if he were confronted by a task such as the American is now beginning. He has never been compelled to face entirely novel conditions. By long habit of following rules, his methods have taken on the mechanical exactness of his checkrowed woodlands and the comparative absence of need for progressive thought in latter days has resulted very much as might be expected, with some brilliant exceptions.



FORESTERS' CAMP IN IDAHO.

advantage, so far as his work is concerned, compared with his American cousin. His work was an exact science long before he was born. He has only to consult the authenticated records of thorough and comprehensive forest study to obtain data which might cost the American months or years of investigation. As a consequence he can make accurate predictions, which reduce business risks to a minimum, provided he is not asked to go outside of his own bailiwick. At this point the disparity ends.

The Yankee, on the other hand, is the same energetic, inventive pioneer that his great-great-grandfather was before him. Lacking in many cases the erudition of his trans-Atlantic prototype, he attacks a new set of conditions with mind unhampered by dogmatic opinions of what must necessarily be done, and he is going to succeed in the gigantic task before him through adapting his methods to circumstances. These statements are intended neither as derogation of the one nor flattery of the other, but as an expression of recognized facts. Each

man is more successful in his own work than the other probably could be.

The forest work done in this country has gone far enough to show the necessity for an American system of forestry based upon sound principles and thorough knowledge of their local application. Forestry in America differs* from forestry in Europe in details and policy, just as does forestry in India. European forests are rich in suggestion for American foresters, but the effort must be to build up an American forestry in harmony with American conditions, rather than to apply, under these conditions, a form of forestry which is the direct result of local factors fundamentally different.

The United States is not only a virgin field to the forester, but also an extremely difficult one.

It is impossible here, as might happen under a strongly centralized government such as Germany has, to remedy the faults of our forest policy promptly

*The American work which most closely approaches the European idea of forestry is the preparation of plans for management of woodlots.

and efficiently by law. Our President deploras the injury that is constantly being done to the national interests, but can not prevail against individual selfishness and ignorance, provided there is enough of it to block the ways in Congress.

The great extent of the country multiplies the difficulties, both on account of the enormous area and the variety of climates to be found. Each region has its own peculiarities of timber and growth resulting from myriad combinations of latitude, altitude, and rainfall, varying from tropical to arctic, from the line of eternal snows to points below sea-level, and from practically no precipitation to more than 100 inches annually. Counting in the Philippines, the total list of woody species amounts to more than 1,200, of which at least 135 are merchantable.

Naturally the study of such a mass of material and the establishment of scientific treatment of merchantable forests on such a territory can only be attempted by some such organization as the Bureau of Forestry. There are two such bureaus—one in the Philip-



INITIATING A NEW MAN. SOUTH DAKOTA.



COUNTING RINGS OF ANNUAL GROWTH WITH A LENS.

pinces and one at Washington—under different departments and having no official connection. An explanation of the work of the tropical bureau was given in *FORESTRY AND IRRIGATION* for April by Mr. Wilhelm Klemme.

The work of the Bureau at Washington is divided conveniently as follows: Into preparation of working plans, surveys of forest reserves, the extension of forest areas by planting and otherwise, and investigation of forest products. Each of these branches of work corresponds to an official division of similar name.

The most extensive branch of activity is the preparation of working plans for large tracts of forested lands. A working plan, it may be said, is a carefully thought out scheme for the treatment of a specified area of woodland, based on a study of past and present conditions of growth and designed so to supplement and aid natural conditions that the forest shall continually produce and yield the largest quantity and the best quality of wood possible.

In order to make such a plan, two main facts must be ascertained—the

present amount of wood standing and the amount of increase by growth each year.

The observations which must be made are of two kinds, known as forest surveys and stem analyses.

By means of the former the diameter of the trees on about one-twentieth of the total area is actually measured with large calipers. All the trees are calipered 33 feet on each side of compass lines run across the forest, either parallel or in a zigzag manner from one side to the other. Calipering thus for a mile along the line covers 8 acres. From such records may be obtained an average of the entire area, which is believed to vary by not more than one-tenth from the actual stand. Wherever the compass lines cross streams, strike the edge of the timber, or traverse slopes, notes of the distances are taken, which are the data by which a very fairly accurate timber map is drawn.

Attention is also given to the value of streams for driving, the chances for splash-dams, camp sites, railways, and roads, and a mass of information is thus collected which may prove of the greatest

assistance in directing logging operations. In taking stem analysis the men need to have the trees felled and cut into logs. For this reason they follow up the loggers at work whenever possible, although sometimes they have to cut and section the trees for themselves. First they count and measure the rings of annual growth on the stump or the butt log to learn the age of the tree and its rate of growth in each decade of its life. Sometimes, especially in hardwoods, the

the contents of an average tree and multiplying by the number of trees ascertained from the surveys.

The mass of wood which a tree adds to its bulk during any period of its life may, for practical purposes, be considered as a hollow truncated cone. The volume of this conical tube of wood may be obtained by calculating the volume of a solid truncated cone of the same dimensions and subtracting from it the volume of the similar interior figure



FOREST RESERVE WORK IN THE ROCKIES.

rings are so closely crowded that a lens must be employed to distinguish them.

The height of the stump, length of each log, and the length of top added together give the height of the tree. Diameters are measured at each place where the trunk is sawed through, and the thickness of the bark is noted, so that a vertical median section of the tree could be drawn to scale if necessary, and the actual quantity of wood in the trunk can be closely calculated. From these figures the amount of wood in the whole forest can be estimated by calculating

whose base is measured on the stump by the annual rings extending from the heart of the tree to the inner side or beginning of the growth period under consideration.

Thus it may be ascertained at what year of its life the tree ceases to pay good interest, in wood, on the value of the space it occupies. It should not be allowed to stand after reaching that age, and it may be gainful to cut it sooner under some conditions. In this way the plan can name the diameter below which trees should not be cut, in

order to make the most gain in the long run, and also foretell after how many years the tract can be cut over again and supply the same quantity of timber. The plan usually arranges to leave a certain number of mature trees on each acre to seed the new crop, and regulates the amount of grazing permitted and precautions against fire, which latter is one of the most important points.

the utmost skill and write an excellent prescription, but the latter will be of little use to the average layman, or may even do him injury, unless he has the drugs compounded by a pharmacist who can interpret the hieroglyphics intelligently. The two cases are not exactly analogous, for the plans are put in as plain, direct English as possible. The trouble is that years of study are



PREPARING TO ANALYZE A LODGED TREE IN WASHINGTON.

Preliminary examinations are also made of limited areas, such as the military reservation at West Point, in which recommendations for treatment rest upon an inspection by a skilled man, no surveys or analyses being taken. The ultimate success of the recommendations arising from either the calculated working plan or the preliminary examination depends to a large degree upon having a thoroughly competent man to mark the trees to be removed. A physician may diagnose a case of disease with

needed to fully comprehend the ideas of forestry and to modify them to special circumstances in practice.

The working-plans men go to all forested states and territories. They pitch their tents in the southern pines in winter and in the northern or far western states during the summer and fall. In the south they flounder through the gloomy swamps of cypress and black gum, nourished by the traditional hog and hominy and made nimble of foot by occasionally running upon a moc-

casin or water-rattler coiled on a tussock, or hearing the long-drawn bellow of an alligator. Some of the men use revolvers or rifles, and whatever game is secured serves to break the monotony of camp fare.

The southern pines yield pitchy heart-wood, called "fat-wood" by the natives. This makes cheerful camp-fires, albeit somewhat smoky. With good company of an evening and dry blankets, the men can afford to make light of the daily soakings. On the pine lands the work is pleasant enough, and calipering is probably seen at its best, as many as 80 acres having been covered in a day by one crew under favorable circumstances.

In the north and west mosquitoes and black flies are a pest in early summer, and the caliper-man meets exhausting obstacles in the way of steep, rough mountain sides and dense swamps of tamarack, so thickly grown up with

saplings that it is well-nigh impossible to keep track of the ones calipered; but the risk of disease is less than in the south, for the water and food are of far better quality.

For several years back, during the summer, a number of Bureau agents have been engaged in inspecting the forest reserves in the western third of the United States. They have also examined tracts of the public lands in this region with regard to their suitability for reserves, both on the ground of timber resources and from the standpoint of conserving the water supply about the sources of streams which supply the adjacent country for irrigation or other purposes.

The men who do this kind of work ride alone or with a native guide through the mountains, carrying the necessary camping equipment on pack-horses, and thus being entirely free to visit any and all accessible parts of the territory.



CALIPERING CYPRESS AND BLACK GUM IN THE LOWLANDS OF SOUTHEASTERN MISSOURI.



FOREST EXTENSION IN NEBRASKA. HELPING THE GRUB WAGON ACROSS THE PLATTE.

They note the topography, course and flow of streams, species, quantity, and location of timber, and obtain all possible information with regard to mining and grazing matters, so important in the western country.

Available agricultural lands are also noted, and when possible excluded from reserves, for it is not intended that the reserves shall hinder any useful and lawful industry, but rather benefit the greatest number possible.

Upon the recommendation of the Bureau agents, large tracts have been temporarily withdrawn from settlement, some, or parts of which, have been made permanent reserves, and the remainder again thrown open to settlement if its nature proved to be such that it was not necessary or desirable to make a reserve of it.

The men of the Division of Forest Extension do a number of different kinds of work. Some visit citizens who request advice, inspect their land and locality, and then offer the best suggestions the experience of the division has to offer for successful planting of forest trees.

Others are now at work in Nebraska planting jack-pine and other well-

adapted species on the great Sand Hill country. They grow the seedlings in seed beds from seed previously gathered in Minnesota, South Dakota, Wyoming, Arizona, and other favorable localities, and when the seedlings are large enough, set them out where they are expected to grow. Down in the California mountains the slopes denuded by fire or otherwise are being planted with tree seeds.

The study of forest fires is a negative means of forest extension. On this work the investigators either work from the point of view of the scientist or that of political economy. In one case it is to find just how the fire burns and progresses, and its effect on different species, and how it can best be checked.

The other man looks everywhere for the causes that started fire, the amount of loss, actual and involved, studies fire laws, and reports what changes ought to be made to remove the causes and decrease the loss.

Then there are the forest-products men, who work both in laboratories and out of doors. In the laboratories they test the strength of different kinds of wood and experiment with various preservative processes intended to lengthen

the life of railroad ties and telegraph poles. The ties are laid in regular track and closely watched to note the effect of the preservatives used. This is work of great value, since it may be able to replace the oak and longleaf-pine ties with chemically treated beech and other less expensive species.

In all kinds of work the men carry cameras, and are encouraged to photograph matters of interest freely. A report is doubled in value when backed by a good series of intelligently selected views.

But it is not in the Federal service alone that opportunity is offered to the

The most prominent example of private work under a trained man is that of the Biltmore estate of Mr. George Vanderbilt, near Asheville, North Carolina, which is administered along the lines laid down by a working plan under the direction of Dr. Schenck, who also conducts the work of the Biltmore Forest School. More and more the great pulp and logging companies, and the railroads, and manufacturers of hardwoods are seeking the advice and services of expert foresters in carrying on their woodland operations. They pay good salaries and will pay better later on when their need becomes a little more



FORESTERS TRAVELING ON SNOWSHOES IN THE ADIRONDACKS, NEW YORK.

thoroughly trained forester. It seems likely that for many years to come there will be a demand for men who have shown themselves sufficiently capable in the Bureau work to merit official approval and recommendation.

Very recently two such men have been employed in responsible positions, one as forester of the Territory of Hawaii and the other as forester to the State of Wisconsin. New York, Pennsylvania, Connecticut, New Hampshire and Michigan also have foresters looking after their woodlands, who did not, however, pass through the course of government training.

generally evident. Business men of the past century are apt to think that hiring a forester is a piece of useless expense—a twentieth century fad. They got along well enough, they say, and looked after their own woodlands. But the times are changing rapidly. The good old days of big, free timber and small population have gone by forever. Henceforward it is to be always more and more intensely a question of stoppage of waste, of getting the most out of the soil, of securing the fractional margin that was almost despised 30 years ago.

The scientific methods of the forester are the only means that can save the

day, and the sharp-witted modern business man knows it. In good business nowadays nothing costs too much, provided it pays for itself and brings a reasonable surplus of profit. It is not hard to believe that 20 years from now foresters will not be stared at in curiosity when the nature of their occupation is

announced. They will be as much a part of the settled professional world as the doctors, and lawyers, and engineers now are, and, should they suddenly be removed, business interests would feel their loss quite as much as they would the disappearance of some of the others.

THE BIGTREES AND FOREST FIRES.

BY

G. FREDERICK SCHWARZ.

THE bigtree (*Sequoia washingtoniana*) of the Sierras is singularly free from most of the ills that threaten forest trees. It is known to be practically proof against the attacks of insects and fungi. It is windfirm, notwithstanding its flat root system, for its roots extend in a wide circle about the tree and its bole is amply proportioned and well balanced toward the base. Moreover, the crown in mature specimens is comparatively narrow, and is rounded at the top, thus affording only slight leverage in storms. The tops of old bigtrees are sometimes shattered by lightning and occasionally one is broken off in a severe gale, but the injury is rarely serious. New branches and foliage spring up and cover the old wounds.

There remains the common scourge of all forest trees, the forest fire; but it is generally understood that even fire is less harmful to the bigtree and its near relative, the redwood, than to other trees. The thick, spongy bark, which effectually protects the wood, is free from pitch and not very combustible; nor is the wood itself easily burned when exposed, at least in living trees. Nevertheless, many old trees are severely burned at the base. Repeated fires, fed by dead branches and other combustible material at the foot of the tree, finally eat their way through the bark and into the heartwood. Sometimes fire attacks the tree from several sides, and as the injury enlarges inward it may meet with a similar excavation

from the opposite side, and thus form an opening through the middle of the tree. Occasionally the stubs of former branches, or bruises on the trunk, cause the fire to spread higher up the sides. In one of the trees of the Mariposa Grove, the interior of the trunk has been hollowed out by fire all the way from the base to an opening near the top, a distance of about one hundred feet, which has suggested the appropriate name of the Telescope.

Although a large number of bigtrees have thus been burned more or less severely by forest fires, their vitality has been rarely if ever seriously affected; the communication between crown and root system has generally been sufficiently maintained for a continuance of the vital processes of growth; but the fires have caused another kind of injury which, so far as the writer is aware, has heretofore been overlooked. Around the foot of an old bigtree may sometimes be seen a large, circular mound covering the bulging roots and formed by the accumulated debris of twigs, cones, shreds of bark, and needles that have fallen for centuries. These mounds apparently serve a useful purpose in protecting the root system and regulating its supply of moisture. The copious winter rains and the melting snow do not readily seep into the ground close to the bases of the old trees, but the water flows away to the outer parts of the extensive root system, where it is most needed. Most of these

mounds, however, have been partially or even entirely destroyed by fire, and thus the water has found easier access to the middle. By the destruction of the mound, moreover, the tree is deprived of a large amount of fertilizing material, which would otherwise gradually be supplied in solution to the underlying root system.

Lastly, although the trees in being burned are not injured in any way physiologically, they are indirectly harmed and their life is endangered by the change in mechanical conditions caused by the large excavations at the base. These excavations often extend over so large a part of the circumference that considerable sections of the root system are severed from the tree, thereby weakening its principal means of support in severe winds or storms. The burn often extends so far inward that the equilibrium of the tree is also endangered. There is strong reason to believe that this undermining of the butt and weakening of the natural anchorage is the ultimate cause of the fall and death of most bigtrees. Some day the enormous column is rocked out of its center of gravity and wrenched from its natural cables. Almost all the large, recently overturned trees will be found to have extensive fire scars at the base and the remains of a flat root system, considerably reduced in circumference by breakage.

It has always been an interesting

question whether the Sequoia groves, that have been so much admired and marveled at ever since the time of their discovery, were approaching extinction, or whether they were able to hold their own in spite of gradual climatic change and unforeseen vicissitudes. It is generally admitted that while the southernmost groves show some indications of a perpetuation of the species in the occurrence of a young growth of seedlings and saplings, reproduction in the northern groves is much less promising; but it is not certain how far this is attributable on the one hand to climatic conditions, and on the other to the various interferences by man, such as the lumbering of some of these groves and adjoining forest areas, grazing by sheep, and repeated forest fires. The question of reproduction and its bearing upon the future of this remarkable tree has been touched upon from time to time by various observers* with interesting and valuable results. This is a wider question. In the present note the writer has ventured merely to direct attention to the importance of protecting the older trees against forest fires, on account of certain harmful results which have apparently heretofore escaped observation or been insufficiently emphasized.

* See "On the Post-Glacial History of Sequoia Gigantea," John Muir, in *Proc. Am. Assoc. Adv. Sci.*, XXV, pp. 242-253.—George B. Sudworth in Bulletin 28, Bureau of Forestry, U. S. Department of Agriculture, p. 20.

SEARCHING FOR WATERS UNDERGROUND.

INTERESTING WORK NOW BEING CARRIED ON IN SOUTHERN CALIFORNIA BY THE UNITED STATES GEOLOGICAL SURVEY.

SOUTHERN California, a unique region, most widely known, perhaps, for its climate, its oranges, and its beautiful and hospitable homes, is rapidly becoming a winter playground for the people of the United States and Canada. Among the features which make it most attractive for the traveler of means or of delicate health are its constant sunshine and clear, dry air. These necessities mean a limited precipitation and

semi-arid climate; so that while our eastern states receive of rain or snow fall from 30 to 50 inches of water, distributed throughout the twelve calendar months, the valley of southern California receives from 10 to 20 inches, practically all of which falls in the winter months, from November to April. While this assures an abundance of bright days, it does not furnish sufficient moisture to mature ordinary crops on the rich soil,

which is capable of abundant yields when properly tilled and irrigated. The deficient rainfall taxes the ingenuity and energy of the enterprising citizens of the state, and they have developed and conserved the available water supply more systematically here than anywhere else in the Union.

The summits and slopes of the mountain ranges which rim the valleys, condensing the moisture from the Pacific winds, receive the most abundant rainfall. The streams draining these slopes carry the water to the tillable lands of the valleys, where it is diverted directly into the main canals of the irrigating systems, often after being used several times in generating electric power, or it sinks into the alluvium which partially fills and underlies the valleys generally. The excess storm water from the mountains, which sinks into the gravels of the plains and is there augmented by the winter rains of the low lands and the water which returns to the soil from the irrigating ditches, forms an important underground source of supply, which has been extensively utilized of late for irrigation and domestic purposes. It is this source of supply, its quantity, quality, the laws governing its distribution and circulation, and the manner and extent to which it is being developed, as well as the future possibilities, that are being considered by means of an interesting and important series of investigations now being conducted by the western section of that branch of the Geological Survey known as the Division of Hydrology.

In the course of this investigation, upon which a party of scientists is engaged under the direction of Mr. W. C. Mendenhall, hydrologist, it is estimated that 10,000 wells will be visited, measured, and tested. These vary in character from shallow domestic wells to twelve-inch bores, 1,000 feet in depth, which yield 100 miner's inches or more of artesian water. They are distributed from the head of the valley to southern California in the vicinity of Redlands, Riverside, and San Bernardino, famous for their orange groves and charming vistas, to the fertile peat lands of Orange county, close to the shores of the Pa-

cific and the beautiful Pasadena and Los Angeles itself. Past developments have recorded a number of artesian basins varying in area and importance, and many thousands of acres of other water-bearing lands, from which a more or less abundant supply may be secured by pumping, tunneling, or other engineering devices.

It is difficult for the easterner to comprehend the vital importance to Californians of the water supply and of everything pertaining to it, or to realize the amount of capital, energy, and skill devoted to increasing and preserving it; but when we consider that by a careful distribution of available water, lands formerly worthless have been given a value of \$2,000 or more per acre, and whole communities with property interests, representing many millions of dollars, have been built upon sterile plains which, without the water brought to them by engineering skill at enormous expense, would be inhabited only by coyotes and jack rabbits, and would yield nothing but greasewood and prickly pear, we begin to understand how intimately the problem of water supply is bound up with the life of the community; or when we remember that in the days of the Padre, and after, of the first Mormon settlers, only the small areas of naturally moist land were regarded as of value, and that these yielded then and yield now only hay and grain, or serve as stock ranges, and compare these areas with the modern, immensely more valuable communities, in which the citrus fruits are raised and the majority of wealthy homes have been established through the development and distribution by engineering skill of the flowing waters from the mountains or the underground waters in the valleys, we may comprehend the intense interest felt by all southern Californians in everything that pertains to the water question; for they, better than anyone else, realize that the life of all the better part of their delightful land depends upon the maintenance of this supply.

There are communities which support enthusiastically the plans of the Bureau of Forestry for the reforesta-



SCENE SHOWING THE RESULT OF TERRACE IRRIGATION AT REDLANDS, CALIFORNIA.

tion of the slopes of the Sierra Madre Mountains, and which fight bitterly the sawmill magnate, who for immediate profit denudes them of their timber cover and paves the way for wasteful floods; likewise they prosecute relentlessly the careless camper who permits his fire to spread into a destructive conflagration. It is in recognition of these strong interests that the present work is being done by the Division of Hydrology on the underground water supply.

The result of this work will be presented to the public in a series of reports, which will contain maps showing the area and distribution of the artesian basins and other water-bearing lands,

with contours of the water planes, giving the depth at which water is to be expected at any point; and purity lines, showing the character of the water, and inferentially its source in some cases. There will also be published a general discussion of the structure of the water basins from the geologic point of view, their character and extent, the circulation of the water within them, its conservation, and, so far as conclusions may be drawn, the lines of safe development. It is expected that one or two of these water-supply papers will be written this coming summer and issued as soon thereafter as possible.

BOISE-PAYETTE IRRIGATION PROJECT.

AN INVESTIGATION BY THE RECLAMATION
SERVICE THAT PROMISES TO MAKE A TREMEN-
DOUS ADDITION TO THE PROSPERITY OF IDAHO.

BY

C. J. BLANCHARD.

THE marvelous development of the great West offers an instructive subject for the consideration of every citizen of this country whose interest and pride in his native land extends beyond his own immediate surroundings.

A wonderful impetus is being given to the growth of the arid West by the work of the government under the irrigation act. Uncle Sam's engineers in every Western State are exploring the mountain fastnesses for favorable reservoir sites, hydrographers are measuring the flow of streams, and surveyors are laying out the lines of broad canals across desert wastes.

In Arizona and Nevada construction work has actually begun on systems involving the expenditure of millions of dollars.

Two of the fairest and most fertile valleys in the arid West, the valleys of the Payette and Boise rivers, in southwestern Idaho, are soon to be the scene of a stupendous irrigation work by the government. Three hundred and sev-

enty-two thousand acres, or more than the total irrigated area in Arizona, Washington, or New Mexico, are to be brought under one comprehensive national irrigation project, and fully 270,000 acres reclaimed from sage brush to productive orchards and fields of alfalfa. The 100,000 acres now irrigated in these valleys are to be guaranteed an ample water supply for all time to come. The stored waters of Payette River are to be diverted through a tunnel under a low divide, and together with the restrained floods of the Boise are to be spread over these famous valleys, making possible the building of hundreds of prosperous and happy homes.

The Boise-Payette project is in two sections, the first comprising a masonry dam in Payette River with a canal on each side of the stream, the south side ditch connecting with a large pumping plant. Under this system 1,000 cubic feet per second will be diverted for irrigation to 150,000 acres of land. The dam will be 90 feet high, 450 feet long

on top, 125 feet on the bottom, and the capacity of the reservoir will be 190,000 acre feet. The north-side canal will have a length of 20 miles and the south side 40 miles. The estimated cost of this section is \$1,200,000.

Section number two is a diversion from the Boise River. The works consist of a dam 10 feet high, 400 feet long on top, and 400 feet on the bottom, constructed of concrete, steel, and timber. The capacity of the reservoir is 150,000 feet. Two diversion canals, one on each side of the river, will have a combined length of 135 miles and a bottom width varying from 45 to 90 feet. The estimated cost of the Boise section is \$2,000,000, and the estimated cost of the entire project is \$3,200,000. The actual area to be benefited by both sections is estimated at 372,000 acres.

No other section of the United States presents a more attractive field for the reclamation engineers than is found in these valleys. The lands lie at an elevation of 2,100 to 2,800 feet, the climate is the very best found in the arid region, the winters being moderate and the thermometer rarely reaching zero, and freedom from wind and an unusual number of bright, sunshiny days mark the winter months. The summers are long and warm, and with irrigation promote the most rapid vegetable growth. The soil is rich, productive, and adapted to all the fruits and cereals of the temperate zone. All deciduous fruits and berries produce abundantly, and apples and prunes especially are shipped in quantities to eastern markets, where they bring the highest prices. With a sufficient water supply there is no uncertainty as to the productiveness or adaptability of this region to intensive farming. Cultivated lands on every side similar in nature are ample evidence of their value.

Since the government withdrawals were made under this project more than 13,000 acres have been filed on under the reclamation act by intending settlers. More than 100,000 acres of public land and 60,000 acres of state land are embraced in this area. There is every reason to believe that as soon as the actual construction has commenced every acre of public land under this project will be taken in a single season.

An especially interesting feature in connection with this great work is the fact that its construction by the government means not only a vast increase in the cultivated area of this part of the state, but also the final settlement of the vexing questions and contentions now arising in these valleys from an effort to make a limited amount of water do service on what is practically an unlimited amount of land. It means the passing of the promoter and ditch manipulator and the substitution of the irrigator and business man. It means that in a few years an advancement can be made under this government work that by the unaided efforts of the people would never be possible. It means the laying of the foundation for improved agricultural conditions, for better transportation facilities and industries of every kind. Above all, it means homes and living for a quarter of a million people.

Deep in the hearts of Idaho's mountains the miner's pick is finding the precious metals; in her towering forests the woodman's ax is felling her giant timbers, and soon in her desert valleys, smiled upon by the genial sunlight nearly every day in the year, the grasses will quiver, the golden harvests will bend in the breezes, and orchards will glow with ripening fruit. Of the wealth deep bosomed in her tree-clad mountains or sparkling in the sands of her silvery streams much has been written, but of the greater wealth which lies in her valleys of inexhaustible fertility much will yet be said. These valleys, picturesque and beautiful, fertile and healthful, offer ideal homes and opportunities for winning comfort and fortunes.

The Secretary of the Interior tentatively has approved the plans of the irrigation engineers, and in compliance with a request of the majority of land owners of the Boise and Payette valleys, has ordered a continuance of the surveys and investigations with a view to setting aside a sufficient sum for the completion of this important work as soon as the settlers perfect the necessary organization to secure to the reclamation fund the return of the money required for the construction of the work.

The average size of irrigated farms in this section of the state is 40 acres. The average value per acre of irrigated land, according to the last census, is \$58. The value of farm property per farm is \$2,060, including buildings, implements, machinery, and live stock. The gross income per farm, not including products fed to live stock, in 1900, was \$1,224.

Using the above unit averages, the result of the successful completion of this great irrigation project may be briefly summed up as follows:

New farms	5,500
Increase in irrigated land, in acres.	272,000
Value of new farms at \$58 per acre	\$15,776,000
Value of farm property, including live stock	12,430,000
Total increase in farm values	28,206,000
Total gross annual income from new farms	6,732,000

The Boise-Payette project alone will add 42 per cent to the value of farm property and 37 per cent to the gross income from farms in Idaho. A project that promises such immense returns deserves the close attention of the people.

SOME FEATURES OF THE SWISS FOREST SERVICE.

BY

AUSTIN CARY,

FORESTER TO THE BERLIN MILLS COMPANY.

PASSING acquaintance for three weeks with Swiss forests and forest officers affords slight basis for criticism or even for exposition. It can not fail, however, to breed in any intelligent traveler a hearty respect for the Swiss service and its achievements.

Switzerland and Holland are two countries which should be peculiarly honored for the use they have made of naturally small resources. While the Hollanders have been reclaiming great areas of productive land from the sea, the Swiss with equal persistence and equal genius have been making the very best of their naturally broken and unproductive country. In this work the foresters have had an important share. New woods have been planted and old ones put into productive shape. Mountain torrents have been so controlled that they can do no damage either on the slopes above or the fields below. Safety has been secured to the people from landslips and avalanches, and considerable area added to the productive surface of the country. This work has exercised not only a high degree of technical skill, but it has furthermore, in the free political condition of the

country, involved education of the people and many forms of coöperation between the general government, the cantons, the towns, and interested parties. It is in view of these last facts especially that what has been accomplished by the Swiss should be an encouragement to us in America.

What a difference in the aspect of a country is wrought by an intelligent and progressive people! One has to go no farther than Italy and Greece to see what the results of national poverty, weakness, and disunion may be. The Swiss, on the other hand, seem to be steeped in the ideals of national progress and coöperation. In their situation, indeed, forestry is a prime necessity. With 28 per cent of the area of the country entirely unproductive and the main industries of the people agricultural and pastoral, the 20 per cent that they can spare for forest is not enough, even under good management, to supply the needs of the country for timber. The price of all qualities of wood is very high, and 16,000,000 francs' worth is annually imported from Austria and Germany.

From the simplest point of view, there

fore (that of timber supply), forestry is a national necessity with the Swiss. A general law on the subject has been in force for many years, but it was extensively revised in 1902. This code asserts in the first article that the oversight of all forests within the limits of the country is within the province of the general government, whether those forests are the property of any public body or whether belonging to individuals. The second provision of the law is the definition of *Schutz* or protection forests, those whose maintenance is for any reason a necessity to the country, and such as can not be so considered. In management the plan is to secure a certain standard and uniformity without violating local independence. To the cantons is left the regulation of their own or municipal woods, and the control exercised over private forests within their limits, while to a central bureau at Berne is reserved the right to veto appointments made and to see that work is done within the lines of the federal regulations.

How this works will be best illustrated by the arrangement in force in Canton Zurich. This canton has 47,024 hectares of (116,000 + acres) forest, of which 53½ per cent is owned by private parties, 4.5 per cent by the canton, and the balance by towns and various quasi-public associations. The canton has an Oberforstmeister, with important duties in case of dispute, appeal, etc., and four Kreisförsters, each of whom is responsible for all woods within the limits of his district. The Kreisförster manages the cantonal forests; he keeps run of the private woods and specifies what owners are allowed to do and what is forbidden; he keeps check on the more or less highly trained managers who run the town and corporation forests. Each town or corporation owning forest can choose its own manager, who is locally paid. He must, however, be approved by the forest authorities of the general government, which means almost always that he is a graduate of the forest school at Zurich. Frequently separate holdings of woodland are united for economy's sake under one manager.

One of the charms of the Swiss woods,

which also adds to their value for purposes of study, is the great variety that may be seen on a small area. All Switzerland is only half as large as Maine, and one can quickly and cheaply traverse it. The most characteristic stands, perhaps, are those of the mountains, where on the great heights the larch and spruce hold sway, and lower down come the fir, beech, and other native tree species. Here the wind is a big factor, while the necessity for maintaining a perpetual cover oftentimes entirely dominates the management. Selection forests and very light cuttings are therefore the rule. Here also may be seen clever devices in the way of wood transportation.

The forests of northern Switzerland, on the other hand, are not unlike those of south Germany—varying stands of spruce, fir, and beech for the most part, with a rotation between 80 and 120 years, and natural regeneration, where they can get it, stretching over a sufficient period. There is a good deal of pure spruce here, planted since about 1850, but these pure plantations are now recognized as bad policy, the tendency being distinctly toward more natural forms and management.

As for particular districts, the Sihlwald, near Zürich, has been visited probably by every American forester who has made any inspection of the country, but there are numerous other districts which the Swiss themselves seem to regard with equal pride. Biel is a *bezirk* remarked for its fine and varied woods and its excellent management. At Winterthur the Swiss are now watching with great interest the success of the local officer in the natural regeneration of spruce. Chur again, a mountainous district in the east, is said to illustrate a great variety of forestal conditions and of protective work as well.

Forstmeister Marti at Interlaken is looked on as one of the most capable managers in the country. He certainly proved himself to the writer a most cordial and accommodating man. It was of great interest to see under his guidance the protective work in the Lauterbrunnen valley above Interlaken, which alone has rendered the much traveled

railway to Grindewald and the Jungfrau safe and practicable. 120,000 francs have been expended here, to which, as a public utility, the *Bund* contributed 50 per cent, the canton 30 per cent, the town and the railway 10 per cent each.

This sketch would fail in its main purpose if it neglected the personal impressions gained at the annual *Versammlung* of Swiss forest officers held last summer, which the writer had the pleasure of attending. It is when a man is unbent often that you can tell most about him, and if one might trust his eyes and ears on the occasion mentioned, Switzerland is served in this direction by a particularly effective body of men. This was signified not merely by the note of patriotism and public service that was so often sounded in their speeches, but in the make-up of the body as a whole and in the capacity and temper of individuals. All needful types of men were there, from the professor or editor posted on progress in all parts of the world, down to the humble manager of a few hundred hectares of forest belonging to some town. Again, while one may be easily mistaken on such a point, the temper of the men seemed to be thoroughly sound and natural. They were neither too coarse nor too fine for their work, but a well equipped, serviceable body, animated with a high degree of *esprit de corps* and strong love of country. That they thought for themselves and were dominated by no authority was perfectly evident from the criticisms one heard during the field excursions.

Two things were remarked in my observation and study that seem particularly valuable to workers in this country. First is the extent and variety of federal aid extended to the Swiss forestry work. Thus to the salaries of the cantonal forest officers the *Bund* contributes 25 to 35 per cent, and less amounts to the managers for towns and public corporations. To the salaries of forest guards 5 to 25 per cent is contributed by the *Bund*, which also supports yearly courses for their instruction. Accident insurance is provided for all forest officers, and in the cost of this the *Bund* bears a third.

Schutz, or protection work, whether in the way of stream correction or of plantation, is recognized as a matter of general concern. If for this purpose land is to be acquired by the cantons from private parties, the *Bund* may contribute 50 per cent to the cost, without, however, sharing in the acquired title. From 50 to 80 per cent of the cost of new plantations may be paid by the *Bund* and a similar amount toward essential works of stream fixation or correction. Furthermore, if in any publicly owned forests unusual plantations are necessitated by fire, insects, or any other agency, the *Bund* contributes half, while to the cost of roads or other essential means of development it may give 20 per cent. In all cases where these aids are given, the federal authorities assure themselves that the work is carried on in the highest approved manner; so that by this coöperation the interests of the country are furthered in two ways.

The degree and the method of control exercised over private forests varies in the different cantons, as does also, no doubt, the degree of success. Throughout the country there are certain areas recognized as protection forests, which are held strictly, whatever the ownership, under public control. Thus in every canton clean cutting may be prohibited by the authorities or allowed only on the condition of immediate replanting. In some cantons, however, the control goes much farther than that. The public officers may mark the cutting in private woods, and in Canton Zurich may even order planting of a given amount and kind. It was interesting to note that in this canton, in the opinion of many, the officials have too much authority over private woodlands.

In general, however, the relation of the forest officers to the people seems to be a mixed one, involving authority, instruction, and persuasion, in which case, of course, results vary largely with the talent and tact of individual men. Of the success attained some discouraging talk was heard; but, on the other hand, a number of men, who had that very work to do, expressed themselves

as well satisfied with the results. They said men had been led to take an interest in their woods, and, further, that private owners tactfully handled were entirely capable of learning and applying the main principles of good forest management. In short, the general

judgment seemed to be that the private forests of the country were in reasonably good bearing condition. This, considering particularly the thorough democracy of Switzerland, should be very encouraging news to workers in forestry in our own country.

PROPOSED RECLAMATION WORK IN NORTH DAKOTA AND MONTANA.

IF ENDORSEMENT OF THE PEOPLE IS SECURED, THE FORT BUFORD PROJECT WILL LIKELY BE TAKEN UP.

A MEETING of great importance to the citizens of North Dakota and eastern Montana was held recently in the office of Chief Engineer Newell, of the Reclamation Service. Senator Hansbrough, Congressmen Spaulding and Marshall, of North Dakota, and Congressman Dixon, of Montana, were present.

The Fort Buford project in the Yellowstone Valley was under discussion, and the detailed maps and preliminary estimates of the engineers were carefully gone over. The engineers' reports indicate that the project is feasible. A canal 70 miles long will irrigate approximately 70,000 acres at a cost of \$25 per acre. This land is adapted to alfalfa growing, a most valuable crop in this section, where stock-raising is the predominant industry.

It was decided at the meeting to present the plans to a board of consulting engineers for final approval, before recommending the project to the Secretary of the Interior for consideration. The physical questions surrounding the Fort Buford project seem capable of solution, but the scheme is complicated by problems of another character which must be settled before the work can be begun.

The lands belonging to the proposed canal system are largely in private ownership, 50 per cent of those in North Dakota and 65 per cent in Montana having passed from the government. Should the Secretary approve this project and set aside a fund for its construction,

work could not be started until the owners of private lands formed an association and agreed to refund to the government the amount expended in the construction of the work. The estimated cost is \$25 per acre, payable in ten annual installments of \$2.50 each, without interest.

The lands belonging to the government will be opened to entry to *bona fide* homesteaders and will be subject to the same terms.

The Fort Buford project is now in the position of waiting for the endorsement of the people. The preliminary work has been done and the government is in a position to pass upon it so soon as it shall be made acquainted with the wishes of the people. From now on the people must take the initiative, perfect an organization, and present their petition in proper form to the Secretary of the Interior.

The estimated cost per acre for this work seems somewhat high, but it is believed that the increased productiveness of these lands, under a canal system which will give them an ample water supply, will prevent this cost from becoming a serious burden on the settlers in this valley.

One of the North Dakota Congressmen pointed out that if a permanent water supply would increase the yield of these lands to the amount of one ton of alfalfa per acre, it would suffice for the annual payment required by the government.

POWER DEVELOPMENT MENACES IDAHO IRRIGATION.

BY

FREDERICK HAYNES NEWELL,

CHIEF ENGINEER, U. S. RECLAMATION SERVICE.

IT is doubtful if any state presents a better field for operations under the Reclamation Act than Idaho.

The arid portions of that state are favored with a fine climate, plenty of good irrigable land, and large streams whose discharge can be easily controlled. All that is necessary to insure material development of this arid region is the bringing together under proper relations of two of these resources, land and water, which can be done at a comparatively small cost per acre. There is an earnest desire on the part of the citizens of the state that irrigation development by the national government be pushed forward on broad lines. The people, however, are singularly blind or strangely indifferent to the manner in which their interests are endangered by certain promotion companies.

Irrigation development at its very inception in the Snake Valley is threatened by the proposed construction of a power plant, the promoters of which claim the right to use the only supply of water available for irrigation. Already more than four times the low-water flow of Snake River is claimed for the development of power. The two large Carey Act projects now well under way in the Snake River Valley, together with the two feasible projects recently investigated by the Reclamation Service, will, when carried to completion, reclaim more than 635,000 acres of land, practically double the

area now irrigated in that state. These lands lie in large bodies, which insure the building up of important centers of wealth and population. All this splendid development depends upon overcoming the condition of aridity, for without water these lands must forever remain in their present desert state.

The theater of this future activity lies comparatively remote from any large town or settlement, being 150 to 200 miles distant from Boise, and about the same distance from the most important centers of population in Utah. Today these bodies of land form part of the vast unbroken wilderness of sage brush which stretches across the state from east to west, a desert scene never to be forgotten by even a western traveler.



TWIN FALLS, 180 FEET HIGH; ON THE SNAKE RIVER, IDAHO.

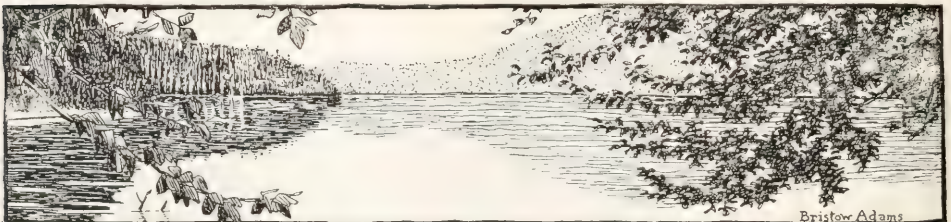
Provided with water for irrigation, orchards and meadows, villages and towns, and in a few years even cities would greet the eye. The increment to agricultural wealth in the state following the irrigation of these lands would aggregate more than sixty millions of dollars, and several hundred thousand people would be added to the population of the state. Irrigation must come first, and in order to irrigate these lands the right to use the waters of Snake River must, of course, be unquestioned.

The prospect of early irrigation and settlement of these large areas has excited interest in the possibilities of power development in that region, and a few promoters have been quick to take advantage of imperfect laws and have obtained power rights on the stream. These power plants are to be located at Shoshone Falls, a point where the river makes a vertical drop of more than 200 feet. The choice of a site for this enterprise is most unfortunate, as it is below practically all the irrigable lands in Snake River valley. It would require the use of all the storage facilities on the South Fork of this stream and more, or about 1,000,000 acre feet, to furnish the water claimed for this purpose alone. If the splendid storage facilities are to be used for this purpose, there would be a supply of water in the river for irrigation for only about three months of each season, or during the flood discharge of the stream. On the other hand, if these lands are to be reclaimed, there will not be any water in the river at this point for power purposes for several months during each season, as all the water will be diverted above this point. More than

70 per cent of the irrigable lands of the valley will have to be furnished with water for their late irrigation, necessitating the utilization of practically every storage site existing in that drainage basin for that purpose.

The nature and magnitude of the conflict between these interests should be readily understood. The impending conflict might be easily obviated if a site for power development were selected above instead of below large bodies of irrigable land. American Falls offers an ideal location for the development of water power. It is located above nearly 400,000 acres of irrigable land, the late water supply for which, to the extent of nearly 3,000 second feet, will have to be furnished from reservoirs. This supply will have to pass these falls, increasing the discharge of the river during its lowest stage from 2,000 to 5,000 second feet, enough for the creation of over 20,000 horse power, which can be developed at very reasonable expense, and without conflicting in any way with the rights of irrigation in any part of the Snake River valley.

The development of cheap power is very essential and is a powerful agency in the building up of any country. The foundation of the development of any arid country is not power, but irrigation, and the right to the use of the streams for any other purpose must be subservient to irrigation rights if such development is to be full and complete. When it is realized that at best probably not more than 4 per cent of the arid portion of Idaho can ever be reclaimed, there should be no question as to the desirability of having these resources fully utilized.



FOREST EXTENSION IN THE WHITE MOUNTAINS.*

INTERESTING STUDY OF REPRODUCTION OF SCRUB SPRUCE AND BALSAM IN ALPINE SITUATIONS.

BY

T. L. HOOVER.

BLACK spruce (*Picea mariana*) and balsam (*Abies balsamea*) have climbed almost to the summit of the Presidential range. Balsam was observed as high as 5,500 feet on Mt. Washington and spruce at 5,300 feet on Mt. Clay. Seeking shelter among the rocks and crouching in the surface hollows, their stunted forms reach out the gnarled and twisted branches, as if joining hands for mutual encouragement and support, and bid defiance to the elements.

This steady upward progress, persistent in the face of adverse conditions of soil and climate, must be the work of many successive generations. And yet a striking fact in this connection is the almost entire absence of fruiting bodies on the upper limits of growth. By the casual observer a cone on either species is seldom seen in these lofty situations, and only careful search will reveal them to a close observer. How, then, does reproduction, so necessary to this steady advance of the species, take place?

In uprooting a balsam for an examination of its root system, the writer was obliged to follow out carefully a slender, wiry root for a distance of six or eight feet from the stock. But the root, instead of tapering down and ending in fine rootlets, was found to be attached to the stock of another scrub balsam. Further examination disclosed the fact that other roots of the same plant terminated likewise in attached but virtually independent plants. In some instances these primary offspring were found to have given rise to a still more recent generation. Thus from a single parent stock a whole clump had been formed.

This, then, is the solution. Instead of being dependent upon the usual reproduction from seed, the plant under unusual conditions has evolved a process of natural root-layering.

Subsequent investigation revealed the same method of reproduction with both the balsam and the spruce. In the shallow, scanty soil the roots of a plant run far out, but close to the surface. Then by some process an aërial system develops from the root, and a new plant comes into being, which in time develops its own root system, and thus establishes an independent existence. In some instances the genealogies of *living* plants were traced back directly to an old *dead* stock; hence a clump of scrub may be regarded as a vitally connected colony arising from one or several parent stocks.

With this explanation in mind, the question arises, "To what extent do the seeds *occasionally* produced take part in reproduction?" The writer was not successful in finding any seed of the previous season. All seed collected was several or many years old. The cones were all undersized, and none of the seeds seemed plump and sound.

Of the seed collected the following was submitted for testing to the Seed Laboratory of the United States Department of Agriculture: *Picea mariana*, 5,100 feet; *Abies balsamea*, 5,000 feet, and *Picea mariana*, 4,400 feet. The first two specimens gave no results whatever. The last gave a germination of 6 per cent. This evidence clearly shows that whatever reproduction takes place in such situations can be to only a very small extent from seed.

* All altitudes are measured from sea level.

The writer believes that this problem offers attractive opportunities for further study to determine the exact process of sprouting from the root system, and to fix more surely, by a greater

number of tests, the reliability of germination from seed.

It is hoped that some one may have opportunity and inclination to complete the study.

THE MILK RIVER PROJECT.

LATEST NEWS CONCERNING A DESIRABLE BUT EXTREMELY DIFFICULT PIECE OF RECLAMATION WORK.

CITIZENS of Montana residing in the valley of Milk River are gravely concerned over the proposed extensive diversion of the waters of that stream in Canada, and are importuning the government to intervene in order that their prior rights to the water may be protected. The government itself is concerned in this matter, as it has constructed an irrigation system at Fort Belknap, which is a prior appropriation to that of the Canadians.

Citizens in the lower Milk Valley fear that the Canadians' works will exhaust the normal flow of the river, leaving them without water during the low stages of the stream. Unfortunately for the Montanans, the government's work of constructing an extensive irrigation system combining large storage reservoirs in St. Mary Lakes with many miles of canals has been delayed, owing to the unfavorable physical features which were encountered by the engineers and to other obstacles in the shape of prior rights and difficulties in securing right of way.

The government project is divided into two sections—the storage of flood waters in the mountain catchment area of St. Mary River and the utilization of the water on the irrigable lands of the lower Milk River Valley. The engineering surveys in the St. Mary Basin are practically completed, but the best method of bringing this water to the lower lands has not yet been found. The simple plan of permitting the stored waters to flow down the stream through Canada in the natural channel has been abandoned, owing to the international complications, and the alternate plan of utilizing Cutbank Creek

and Marias River is receiving careful consideration.

The survey of the Marias River has not been completed, and it is not possible at this time to state whether a diversion is feasible or not. While the engineers consider it a difficult proposition, belief is strong that a way out will be found before the close of the coming field season. The question now being considered is whether it will be wise to start construction work in the lower valley, depending only on Milk River for a supply, and before it is found feasible to bring the waters stored in St. Mary Lakes to this area.

While the engineers do not view with equanimity the diversion of the waters of Milk River by the Canadians, they are not becoming unnecessarily alarmed thereat. So far as can be ascertained from the somewhat imperfect maps of the region, the drainage area of Milk River above the point of diversion of the Canadian ditch is approximately 1,050 square miles. This catchment area is not mountainous, but, on the contrary, consists of undulating or rolling gravel hills, from which the run-off is not notably great. In comparison with this the drainage area of Milk River above Malta, Montana, contributory wholly to the flow of the stream in the United States, is 14,044 square miles. In other words, the drainage area controlled by the Canadians is only $7\frac{1}{2}$ per cent of the total drainage area above Malta. Assuming that there is a larger available run-off in the upper part of the basin, this at most can not be considered as affecting seriously the utilization of the water at points near Malta.

It is recognized that any diversion

of Milk River in Canada is detrimental in a certain degree to Montana, but at the same time consideration must be had as to the magnitude of the diversion and its probable effects upon industries in that state. Assuming that the ordinary rules of priority of appropriation apply to the waters of St. Mary River and to those of Milk River, it is evident that by priority of survey and of construction the Canadians have already acquired an unquestioned right to the use of water for considerable areas of land. Their surveys were made some years ago, and construction has been initiated.

In the case of St. Mary River the Canadians are utilizing a considerable part of the low-water flow, but do not, and probably never can, utilize the flood flow, and this can with propriety be stored in St. Mary Lakes and retained in the United States if the project is feasible.

The same is true of the waters of Milk River. The Canadians by priority of survey and of construction have probably acquired a right to such water as they can obtain, but this quantity is limited from the fact that their diversion canal is high up on the headwaters of the river.

THE FOREST INTERESTS OF OHIO.

BY

PROFESSOR WILLIAM R. LAZENBY.

IN his first message to the General Assembly, Governor Herrick said: "It is evident that the State of Ohio should awake to the benefits to be derived in replacing to some extent, at least, the trees and forests which have disappeared.

"In some of the states of the Union legislatures have wisely provided for the protection of forests and woods. I commend this subject to your serious consideration, to see if some means can not be devised whereby the growth of timber may be encouraged, not only for the profit arising from the growing of timber, but for the purpose of preserving our water supplies, protecting ourselves from disasters of flood, and maintaining climatic conditions which are in some degree dependent upon our forests."

In accordance with these suggestions, a committee appointed by the Ohio State Forestry Society, assisted by others interested in the subject, has drafted a bill, which is now before the state legislature.

The main features of the bill are as follows: First, providing for the payment of a premium or bounty of two

dollars an acre for a period of ten years to any land-owner of the state who will plant and care for forest trees in compliance with the rules laid down by the State Board of Forestry; second, giving the Board of Forestry the power to accept by gift or secure by purchase suitable land in any county of the state that it may deem desirable for forestry purposes, at a cost not to exceed ten dollars an acre, and to be retained as permanent forest reserves.

Every loyal citizen will rejoice to learn that Ohio has at last awakened to the importance of saving her forests. This is not a mere local interest, it is a patriotic duty. All civilized nations of Europe have long since enacted laws for the preservation of trees and for the reestablishment and perpetuation of a generous forest area. New York, Pennsylvania, Michigan, and other states are following in their lead.

Shall the great State of Ohio be blind to her future welfare? Each generation is the trustee and guardian of the natural wealth in soil, climate, and beauty of our commonwealth for the generations to come. Shall we by short-sighted selfishness and negligence destroy our

magnificent inheritance? Is there any crime against nature that draws down a more certain curse than that of stripping the earth of all her forests?

We do not object to the removal of forest trees after they attain their highest market value, nor do we claim that the most productive land should be given up to timber growing. What the friends of the Ohio forests ask is that all land that can not be cultivated or is cultivated at a loss should be set apart for timber growing.

Is it not a fact that a majority of our farmers would improve their circumstances and increase their income by concentrating their efforts, applying their labor and fertilizers on two-thirds of the land they now too often skim and skin, giving the residue back to timber growing?

We confidently look toward two agencies that can scarcely fail to encourage and promote the forestry interests of

Ohio. One is the Ohio State Forestry Society, recently organized, and the other is legislation to which reference has been made.

The Forestry Society hopes to accomplish much good by disseminating knowledge of trees and tree planting, by inciting the more general use of trees for shelter, shade, and ornament, and the growing of trees as a farm crop.

It will also furnish a means of co-operation with the National Bureau of Forestry and the American Forestry Association.

The forestry bill seeks to encourage the production of wood as a farm crop, and to illustrate by state forest reserves how to conserve and improve existing woodland, and to exemplify the best methods of forest planting and management. It also aims to advance the cause of scientific and practical education in forestry by bulletins and reports.

Let us save and improve the forests!

STATE FORESTRY IN MINNESOTA.

BY

GENERAL C. C. ANDREWS,

CHIEF FOREST FIRE WARDEN OF MINNESOTA.

NOTE.—The following address, delivered by General Andrews at the last meeting of the Minnesota Forestry Associations, contains so many valuable suggestions regarding the forests of Minnesota, that could be followed with advantage by other states, that we are reprinting it here.—EDITOR.

PINE COUNTY, in this state, contains 900,000 acres of land, exclusive of water. The German State of Baden, which is smaller than Pine county, has 240,000 acres of state forest, from which it derives an annual net profit of \$660,000. The Kingdom of Würtemberg is only a little larger than our St. Louis county, but it has 418,000 acres of state forest, from which it derives a net annual revenue of \$4 per acre, which is a great deal more than our American farmers derive from their cultivated land. The Kingdom of Saxony has 432,000 acres of state forest, from which it derives an annual profit of \$4.50 per acre. In Saxony

they have ascertained that the average annual increment per acre is 225 feet, board measure. They utilize there all parts of the tree, even some of the roots; so from that state forest they have an annual product of 97,000,000 feet of lumber, board measure, and the forest remains unimpaired. It even becomes more valuable from year to year. Now, there are larger countries with these state forests. Prussia has 6,000,000 acres of state forest, from which it derives \$9,000,000 annual revenue, net, and France has 2,000,000 acres of state forest, from which it derives a net profit of \$1.91 per acre. In these cases, of course, the forests are

not all together. They are in scattered localities and mostly on mountains and on sandy soil. These forests have good roads through them, and they are practically national parks, attractive for tourists, and our American travelers find great delight in going through them.

These are samples of what some of the European countries have been doing for a long time, and they show what could be done in this country. Of course, the revenue of the forest would not be so large in this country as in countries thickly peopled and where labor is cheaper and a market is easier of access.

It is said we must wait until there is a strong public sentiment before we can accomplish much in forestry. There is a good deal of sentiment now for forestry. Governor De Witt Clinton did not wait for any very strong public sentiment before he built the Erie Canal. They laughed at him, and many called it "Clinton's ditch." He was a statesman, and he put it through. There was no very great public pressure brought to bear upon our statesmen in Minnesota, of whom Governor Ramsey was the leader, to provide by law that all the school lands should be sold for not less than \$5 per acre. It was because there was a statesman at the head of affairs that it was done. He looked ahead and had it done. The consequence is that Minnesota now has a school fund of \$15,000,000 and which is likely to be increased to \$25,000,000. What we need is a good, strong man in the legislature who will make forestry a specialty. We have friends in the legislature. They added twelve amendments to our fire-warden law in our last legislature. They appropriated \$20,000 to extend Itasca state park. They passed a law authorizing the state forestry board to buy land for forestry purposes at \$2.50 per acre, but they failed to appropriate the money. It was because there was no man in the legislature to make forestry a specialty, and until we have such a man we will make no particular progress in forestry in Minnesota.

We have been discussing forestry for many years in Minnesota. We have a

forestry board which has been in operation five years. We have such men as Frederick Weyerhaeuser, the greatest lumberman in the country; our friend Mr. Owen; John Cooper, who was president of the State Agricultural Society and a lumberman; Professor Green, Dr. A.C. Wedge, of Albert Lea, and others—in all nine members. We are equipped to plant trees on non-agricultural land, but the legislature has given us no money for that purpose.

Let us suppose you are members of the finance committee or the committee on appropriations in the legislature. You are friendly to forestry, but here comes the governor and prominent politicians and say they must certainly have \$100,000 for the St. Louis Exposition. They must have a lot of money for the state university; they must build some more buildings at the state experiment station; they have four insane hospitals and many other public institutions which must be supported. Members from all parts of the state are clamoring for money, and they will have it; and while they are friendly to forestry, unless we have a man who makes forestry a specialty and fights for it with energy, we shall not get money for forestry.

Now, I trust that when you go home and in due time come to elect senators and representatives you will say to the candidate, "My friend, promise me one thing, that you will give earnest support to forestry measures."

What forestry means for Minnesota is simply this: The remaining original pine timber will be cut in the next fifteen years. Some second-growth pine, if protected from fire, will then be cut from year to year, but it will not be as good as the original growth, and there will not be enough of it for home consumption. Lumber will be dearer and our great lumber industry will decline. There are, however, fully three million acres of waste land in scattered localities which if planted with pine would in time become normal forests, yielding forever a supply sufficient for our home need. Such forests would by their growth perpetually yield a net annual revenue on the capital invested of 3 per cent compound interest, besides many

indirect benefits. On such waste, sandy land it will take on an average about eighty years for a crop of pine trees to grow to merchantable size. Individuals can not wait so long for a crop and they will not engage in the business. The

state, to whom time does not occur, must undertake the work by purchasing waste land and planting it with pine.

The forestry board is ready to go to work. Will you see that the legislature provides us with the means?

SOUTHERN IRRIGATION SUCCESSFUL.

NOTES ON RICE IRRIGATION STATISTICS IN LOUISIANA FOR 1902.

CHIEF Statistician, L. G. Powers, has transmitted to the Director of the Census a preliminary statement concerning rice irrigation in the State of Louisiana for 1902. The report was prepared under his direction by Clarence J. Blanchard, and is based upon information obtained by correspondence. The statistics are for the several parishes and indicate a great increase in rice irrigation since the crop year 1899.

Irrigation in Louisiana is restricted almost entirely to the cultivation of rice, in the production of which cereal this state now ranks first in the United States. A few farmers along the Mississippi River in the vicinity of New Orleans report irrigation of other crops, principally vegetables.

Rice is grown to some extent throughout the entire southern fourth of the state, with the exception of a marshy strip about twenty miles in width along the Gulf coast. Within this rice belt, however, there are two regions where rice is grown by irrigation and where conditions are especially suited to its cultivation. The one embraces the lowlands along the lower Mississippi and its outlying bayous; the other comprises the extensive prairies of southwestern Louisiana. These regions are widely dissimilar in soil, and as a result very different methods of irrigating and harvesting are employed. The delta lands of the Mississippi have a deep, rich, alluvial soil, with an elevation little, if any, above the banks of the streams. Those along the Mississippi are, in many places, considerably lower than the surface of its waters, which are

restrained by high levees. Irrigation is by means of flumes in the river levees, by siphons, and by steam pumps. Owing to breaks in the levees caused by floods, the difficulties to be overcome in properly draining the plantations and the unsuitability of the soil for the use of modern machinery, the rice industry in this part of Louisiana has developed but little in the last six or eight years.

COASTAL PRAIRIES.

Louisiana's present leading position among the rice-growing states is due to the discovery of the peculiar adaptability of the coastal prairies to the cultivation and irrigation of rice. This adaptability was first demonstrated by the large yield of irrigated rice in 1897, which immediately caused a great influx of immigrants and capital. These prairies are comparatively level, with a slight slope toward the Gulf, and have ten navigable rivers and numerous lakes and bayous. The soil is not deep, compared with that of the delta lands, but has proved to be wonderfully adapted to the cultivation of this cereal. It is underlaid with an impervious subsoil which plays a very important part in the economy of rice irrigation. This subsoil not only holds the water on the land, but gives a compact base, so that when the irrigation season is over and the levees are opened, the water runs off very rapidly and the ground becomes firm enough to permit the use of the latest improved machinery.

The prairies are never more than seventy and generally range from twenty



IRRIGATION WELLS NEAR JENNINGS, LOUISIANA.

to thirty feet above the surface waters of the streams and bayous. Throughout the prairie region are numerous ridges slightly higher than the rest of the land. It is upon these ridges that the canals are built by throwing up parallel levees from the outside, making what might be termed an overland canal, instead of cutting below the surface. Pumping plants at the heads of the canals lift the water from the stream into the main canals, whence it is carried by gravity to the point of diversion on the land. On some of the large canals more than one pumping plant is frequently required, owing to the necessity of several lifts to get the water into the canal.

The prairies are underlaid at depths varying from one hundred to four hundred feet with a water-bearing gravel, which, when tapped, furnishes a large supply through flowing wells or wells in which the water rises to within a few feet of the surface.

The advantages of the coastal prairies for rice growing over the other regions in which this crop is cultivated, are numerous and readily apparent, and since the introduction of modern methods and machinery in southwestern Louisiana the growth of the industry has been phenomenal.

The Atlantic Coast planter works at a great disadvantage in that his plantation is virtually a swamp reclaimed by strong dikes and levees from the annual floods and from frequent high tides. The annual cost of protecting his fields and repairing breaks in levees is excessive. His rice fields were originally covered with dense forests, to clear which entailed great labor and expense. Owing to the moist character of the soil, his crop must be gathered by hand and carried to higher land to be threshed and cleaned. Plowing and planting for the same reason are slow and tedious.

In the prairie region the methods of plowing, planting, and harvesting are



AN IRRIGATION CANAL IN THE RICE-GROWING REGION, NEAR JENNINGS, LOUISIANA.

quite similar to those followed by the wheat-growers of the Northwest. Fewer laborers are required and larger areas can be cultivated than in the Atlantic region. The large initial expense for pumping plants and the construction of many miles of canals and ditches is more than offset by the acreage covered and the assurance of large crops.

The year 1902 in Louisiana was one of great extremes. The growing season was marked by excessive drouth, while the hot season of harvest was one of great rainfall. The increased number of pumping plants drew so heavily upon the rivers and bayous in the prairie region that their levels were lowered, and salt water came up from the Gulf. Considerable damage was also caused in the parishes of Plaquemines and Lafourche in the delta lands. The intrusion of

salt water into the rivers and bayous forced the canal-owners to take steps to prevent further losses from this source, and dams costing many thousands of dollars have been built or are being planned to shut out the water from the Gulf.

Irrigators from wells, the supply of which had heretofore proven ample, discovered that many of these were too shallow, and deeper ones have been sunk.

A very important lesson taught by the experience of 1902 is the necessity of more careful grading of the rice fields. Additional levees, with less fall between them, have been thrown up, thus making it possible to irrigate with less water and with more uniform depth, as well as better to utilize the rainfall, which alone will oftentimes enable the planter to save the expense of operating his plant for several days.

FORESTRY AND IRRIGATION IN CONGRESS

A CALENDAR OF NATIONAL LEGISLATION WITH REGARD
TO THE PUBLIC LANDS, IRRIGATION, AND FORESTRY.

April 1.

In the House: By Mr. McGuire: A bill (H. R. 14674) providing for free homesteads on the public lands for actual and *bona fide* settlers, and reserving the public lands for that purpose.

April 2.

In the House: The bill (S. 1558) granting certain vacant public lands in the State of Minnesota to that state for forestry purposes was read, and received formal objection from Mr. Williams, of Mississippi.

By Mr. Mondell: A bill (H. R. 14710) authorizing the use of earth, stone, and timber on the public lands and forest reserves of the United States in the construction of works under the national irrigation law.

April 5.

In the Senate: The bill (S. 4401) granting public lands to the State of Minnesota for forestry purposes was passed with amendment.

In the House: Mr. Mondell, from the Committee on the Public Lands, to which was referred the bill (H. R. 14622) pro-

hibiting the selection of timber lands in lieu of lands in forest reserves, reported the same without amendment.

April 8.

In the Senate: Mr. Warren submitted amendments to the appropriation bills proposing to appropriate \$375,000 for the care and administration of forest reserves, and \$250,000 to meet the expenses of protecting timber on the public lands.

April 16.

In the House: The bill (S. 4636) to validate certain original homestead entries and extend the time to make final proofs thereon was passed.

April 18.

In the Senate: Mr. Perkins introduced a bill (S. 5567) to exclude certain lands from the Yosemite Park and include the same in the Sierra Forest Reserve.

In the House: Mr. Mondell, from the Committee on Public Lands, reported without amendment the bill (H. R. 14710) authorizing the use of materials on the public lands for building national irrigation works.

April 19.

In the Senate: The bill (S. 2994) amending an act entitled "An act authorizing citizens of Colorado, Nevada, and the territories to fell and remove timber on the public domain for mining and domestic purposes," so as to include Oregon, Washington, and California, was passed.

April 20.

In the Senate: Mr. Martin, from the Committee on Public Lands, to which was referred the bill of the Senate (S. 3165) providing for second and additional homestead entries and for other purposes, reported the same with amendment.

April 21.

In the Senate: The Committee on Public Lands reported without amendment the bill (S. 5567) to exclude certain lands from the Yosemite Park and include them in the Sierra Reserve.

The bill (S. 2860) to further amend an act approved January 21, 1903, entitled "An act to amend an act entitled 'An act to provide for the use of timber

and stone for domestic and industrial purposes in the Indian Territory,' " was indefinitely postponed.

April 22.

In the Senate: An amendment to the appropriation bill was agreed to, providing \$10,000 for use by the Secretary of Agriculture in testing chemical preservatives for timber at the Louisiana Purchase Exposition.

April 23.

In the House: The bill (H. R. 7296) for the protection of the public forest reserves and national parks of the United States was passed.

April 25.

In the House: The bill (H. R. 14622) prohibiting the selection of timber lands in lieu of lands in forest reserves was passed with amendment.

April 28.

In the House: Senate Resolution 71, directing the Secretary of the Treasury to conduct investigations relative to the use of the waters of the Colorado River for irrigation purposes, was passed.

RECENT PUBLICATIONS.

The Angler's Secret. By CHARLES BRADFORD. pp. 206. Illustrated. G. P. Putnam's Sons, New York.

Followers of Izaak Walton will welcome a new book entitled "The Angler's Secret." The author is Charles Bradford, who is already widely known for his earlier volumes, "The Wild-Fowlers" and "The Determined Angler." The latter work, which was called by Grover Cleveland "the most pleasant and practical and sensible volume I have ever seen of its kind," was devoted to brook trout only. This new book, which is fully illustrated, treats of the sporting species of both fresh and salt water fish—from the tiny mountain trout to the mighty striped bass of the ocean. It contains a full description of various tackles, and the methods of catching these fish, together with notes of their habits and habitats.

The latter part of the book considers, not so much the methods of actual fish-killing as the glory of the chase—the lovely scenery, pure air, the natural exercise, and the general exhilaration. All these things are appreciated by the true and chivalrous angler more than the actual filling of the creel.

The author quotes often and appropriately from angling authorities ranging all the way

from Izaak Walton to ex-President Cleveland. Not the least praiseworthy part of this admirable little volume is the tasteful manner in which it is illustrated. "The Angler's Secret" is a delightful little book.

The American Carnation; How to Grow It. By CHARLES WILLIS WARD. Pp. 296. Illustrated with colored plates and half-tones. A. T. De La Mare Printing and Pub. Co., New York.

Here is a delightful and valuable book for the large and growing class who love the carnation. It is written from a minute study of the subject, backed up by twelve years' practical experience in growing carnations. Mr. Ward, the author, has been a big factor in bringing the American carnation into the forefront of popularity among flowers in this country. His extensive and admirably equipped gardens have given him unusual opportunities at first hand to make a most intimate study of this flower.

The volume opens with a description of the origin and early history of the carnation, and a special chapter on the "Carnation in America." General greenhouse culture, the preparation of soils, and in fact every detail of car-

nation culture from the first planting to the picking and shipping of the flowers is discussed in a clear, concise manner. Carnation culture in various parts of the country is fully treated, and there is a chapter on the American Carnation Society. A valuable feature of the book is the wide use of illustrations in it. They are wonderfully helpful. This is an exceedingly valuable book for floriculturalists generally, as well as the carnation specialist.

It is of interest to note that Mr. Ward is also a strong advocate of forestry, possessing special knowledge of its practical side through large ownership of timberlands and extensive lumbering operations.

The Nature Library. In ten volumes. Pp. in all, 4,000. Illustrated with plates in full color, half-tones from photographs and drawings. Doubleday, Page & Co., New York.

In these volumes further impetus is given to the nature-study movement; not, however, as heretofore, by stories with a world of what John Burroughs calls "misleading romanticism," but by serving as a pleasant and instructive guide to the animal and plant life around us. There is a charm in each volume, and the scientific accuracy of each writer does not display itself in wearying pedagogy. A volume is devoted to each of the following subjects: "Fishes," "Mushrooms," "Wild Flowers," "Game Birds," "Insects," "Bird Neighbors," "Bird Homes," "Butterflies," "Moths," and "Animals." Each subject is supplemented by illustrations, which constitute almost a volume in themselves and which are true to the subject and yet things of beauty. The volumes have a charm that makes them readable merely as books, and the scope and accuracy of treatment accorded each subject, together with excellent topography and make-up, leaves little to be desired.

NEW MEMBERS OF THE AMERICAN FORESTRY ASSOCIATION.

The following-named persons have joined the American Forestry Association since our issue for March:

Agar, John G., Bank of Commerce building, 31 Nassau street, New York City.
 Bartrum, S. C., Forest Supervisor, Roseburg, Ore.
 Booth, George G., 605 Trumbull avenue, Detroit, Mich.
 Canby, Henry M., 1101 Delaware avenue, Wilmington, Del.
 Cristy, Harlan P., 520 Atwater street, East, Detroit, Mich.
 Crosby, William A., Hinckley, Me.
 Detwiler, S. B., Bureau of Forestry, Washington, D. C.
 Dike, Miss A. M., 29 Washington square, New York City.
 Ehrehart, J. E., State Tax Department, Albany, N. Y.
 Eno, Miss Mary P., 18 West Thirty-eighth street, New York City.

Hazen, George H., 32 East Seventeenth street, New York City.
 Hinckley, Rev. George W., Hinckley, Me.
 Hinderlider, M. C., Chamber of Commerce, Denver, Colo.
 Hogue, A. H., Fresno Flats, Cal.
 Huthinson, John P., Georgetown, Burlington county, N. J.
 Kehrer, G. F. W., Lagersdrift, District Middleburg, Transvaal, South Africa.
 Kelley, William E., 901 Chamber of Commerce, Chicago, Ill.
 King, Clark, 25 Claverly Hall, Boston, Mass.
 McLennan, J. S., Petersfield, Sydney, Cape Breton, Canada.
 Morley, George, 520 Atwater street, East, Detroit, Mich.
 Peery, E. H., Livingstone, Ariz., care of U. S. Geological Survey.
 Pope, Willis T., Honolulu, T. H.
 Robbins, Royal, 373 Washington street, Boston, Mass.
 Rowe, Henry C., 490 Orange street, New Haven, Conn.
 Smith, Walter M., Stamford, Conn.
 Viles, Mrs. E. P., Skowhegan, Me.
 Weber, W. Hoyt, Stamford, Conn.
 Weddle, Harry H., El Cajon, San Diego county, Cal.
 Wing, John B., 22 William street, New York City.

PUBLISHER'S NOTES.

NURSERYMEN SHOULD BE SURE.

Any system that reduces chances of error in labeling nursery stock is worth earnest consideration. When a man pays for fruit trees of a certain variety, it is good policy for the nurseryman to make sure his customer gets them.

The success of Carl Sonderegger, proprietor of the German Nurseries at Beatrice, Nebraska,



has grown out of his extreme care in delivering just what is paid for. This policy has developed a long list of confiding customers for nursery stock, who are certain that when it buds, leaves, and bears it will be the exact variety they wanted.

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deregger is a careful shipper, and his trees and plants all arrive in a sound, healthy, growable condition; in fact, he guarantees their safe arrival at any railroad station in the United States to which shipments are made. Damp moss and expert packing are the reasons why he can send nursery stock to any address. His catalog is a good one to have at one's elbow. He sends it free anywhere.

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A beautiful map, valuable for reference, printed on heavy paper, 42 x 64 inches, mounted on rollers; edges bound in cloth, showing our new island possessions, the Trans-Siberian Railway, Pacific Ocean cables, railway lines, and other features of Japan, China, Manchuria, Korea, and the Far East. Sent prepaid on receipt of 25 cents in stamps by W. B. Kniskern, P. T. M., Chicago & Northwestern Railway, Chicago, Illinois.

DEPENDABLE KNIVES.

The illustrations herewith show Marble's 6-inch Ideal hunting knife with three styles of blade, Nos. 1, 2, and 3. The blade as at present made is a modification of the two shapes of blades formerly made, known as sticking and skinning points, and is claimed by many expert hunters and woodsmen to combine more of the essential qualities for all-round use than are usually found in one style of knife.

The new blades are slightly thinner than the old pattern and carry a more gradual bevel back of the edge. The bone chopper at the back of point is a valuable feature for rough work.

The solid hard-rubber handle, No. 3, is considered by some to be superior to any other material for the purpose. The heavy tang, threaded at the end, just fits the mortise in the handle, and a half-inch brass nut counter-sunk in the end of the handle, engaging with threaded tang, makes the strongest fastening that it is possible to make.



No. 1.



No. 2.



No. 3.

The stripes or trimmings at each end of the No. 1 and No. 2 handles are made up of alternate washers of colored hard fiber and brass or German silver, that are a driving fit on the tang. The center of the No. 1 handle is composed of leather washers put on under heavy pressure and held in place by the nut counter-sunk into the end of stag tip. The No. 2 is the same construction, except that the center is composed of two grooved slabs of selected stag riveted together and driven on the tang the same as the washers.

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The work of the Foresters is, to a large extent, technical; that of the Inspectors more administrative and less technical.

Examinations will be held in different parts of the United States about July 1 and November 1. For detailed information apply to the Bureau of Forestry, Washington, D. C., or to the Bureau of Insular Affairs, War Department, Washington, D. C.

Foresters and Inspectors now in the Philippine forest service and having from two to three and a half years' service, find the work very attractive, instructive, and healthful.

Copies of the Philippine Civil Service Manual may be obtained from the Bureau of Insular Affairs, War Department, Washington, D. C.

The reports, bulletins, and other publications of the Philippine Forestry Bureau should be read by all desiring to enter the service. Copies may be obtained by addressing the Forestry Bureau, Manila, P. I.

Marble's Fish Knives



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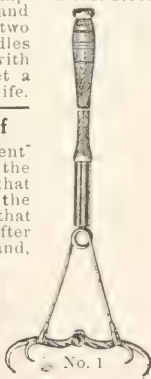
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1. The adoption by the Federal Government of a permanent policy for the reclamation and settlement of the public domain, under which all the remaining public lands shall be held and administered as a trust for the benefit of the whole people of the United States, and no grants of the title to any of the public lands shall ever hereafter be made to any but actual settlers and homebuilders on the land.
2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.
3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.
4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.
5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.
6. The holding of an annual Irrigation Congress, and the dissemination by public meetings and through the press of information regarding irrigation, and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through irrigation and intensive farming, and the need for agricultural education and training, and the creation of rural homes as national safeguards, and the encouragement of rural settlement as a remedy for the social and political evils threatened by the congestion of population in large cities.

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HARDWOOD.—5,000 acres in Tuscaloosa county, six miles from railroad; 40,000,000 feet hardwood. **\$55,000** for timber; **\$65,000** for fee.

ARKANSAS

43,000 acres of timber land, a continuous body, located on both sides of a navigable river and convenient to 3 lines of railroads. Logging operations can be conducted all the year round at a very low cost. Labor cheap and plentiful. A large milling concern in this locality cuts and delivers logs from stump to mill for \$1.50 per thousand. The timber is estimated to cut on an average of 26,000 feet per acre; some acres will cut as high as 80,000 to 100,000 feet. The character of timber per acre, estimated, to cut as follows: Oak, 6,000 feet; Gum, 5,000 feet; Ash, 2,500 feet; Pecan, 4,000 feet; Persimmon, 3,000 feet; Hackberry, 2,000 feet; Elm, 1,000 feet; Cypress, 1,000 feet; Locust, 1,000 feet; Tupelo Gum, 1,000 feet. This tract is unexcelled of its kind in the South. Full particulars, together with price and terms, furnished on application.

HARDWOOD.—76,000 acres on both sides of the Ouachita River, in Union, Bradley, and Ashley counties, Arkansas, with splendid transportation facilities. It consists of hardwoods with a little Pine, and will cut an average of 6,000 feet to the acre. About 70% of this amount is White Oak, and the remaining 30% is divided between Red and Willow Oak, Pine, Cypress, and Gum. Disinterested individuals who have just returned from ranging this timber speak of it in the highest terms and say that as a milling proposition it is by all odds the best they have seen in the South. The average cut given above is based on a very careful and conservative estimate made of 69,000 acres, the balance having been made after the estimate was made. The soil is very rich and fertile and when ready for the plow will sell for more than is now asked for land and timber. **\$5.50 per acre.**

HARDWOOD.—10,000 acres in Arkansas; on railroad and also navigable river flowing into the Arkansas. Will cut 10,000 feet per acre; large percentage White Oak; balance Red, Burr, Water, Post, and Overcup Oak, Ash, Gum, and Hickory. **Price, \$5.50 per acre.**

FLORIDA

CYPRESS TIMBER.—Near the St. John's River, about 1,400 acres of good cypress timber; can be bought cheap for the quality; located in the midst of a forest of Longleaf Yellow Pine, also at a reasonable price. Full particulars given on application.

• **LONGLEAF PINE.**—20,000 acres in one body. Will cut 2,500 feet per acre of 8x8, 30 feet and upward, round timber, *i. e.*, has never been turpentine. Railroad crosses corner. If taken in one body, price, **\$3.00 per acre**

FLORIDA—Continued

LONGLEAF PINE.—417,000 acres, estimated to cut 3,000 feet to the acre. **Price, \$3.00 per acre.**

LONGLEAF PINE.—140,000 acres. This is guaranteed to cut 2,500 feet per acre. **Price, \$2.50 per acre.**

LONGLEAF PINE.—500,000 acres, and can add 500,000 acres more, making one million acres in one solid body of virgin Pine and Cypress. **Price, from \$2.50 to \$3.00 per acre.**

CYPRESS.—3,000 acres in south-central part of state. Will cut 30,000,000 feet. The price to immediate purchaser is **\$30,000.**

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LONGLEAF PINE.—50,000 acres in western Florida. Cut 3,500 feet per acre; transportation good; virgin timber. **Price, \$125,000.**

LONGLEAF PINE.—20,000 acres in central part of state, 2½ miles from railroad. Estimated cut is from 3,000 to 4,000 feet per acre. **Price, \$3 per acre**

LONGLEAF PINE.—16,500 acres in northwest part of state, guaranteed to cut 88,000,000 feet. Splendid transportation. This is one of the very best propositions that we know of in the state of Florida. **Price, \$8.25 per acre.**

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LONGLEAF AND SHORTLEAF PINE.—100,000,000 feet with double circular sawmill, planer, two-room standard dry-kiln, good sheds, 75 or 80 tenant houses renting for from \$3 to \$10 each a month; log road seven miles long laid with 35-pound steel rails, three miles more graded and right of way cut for ten miles, and in addition 7,000 to 10,000 oak ties. Mill has a capacity of 75,000 to 80,000 feet per day. **Price, \$1.60 per thousand feet for timber, and at cost less reasonable shrinkage for mill and plant.**

SHORTLEAF PINE.—700,000,000 feet of Shortleaf Pine. The Iron Mountain R. R. is now building directly through this tract. 8,000 acres of this tract are in fee-simple, which goes with the stumpage. The owner will sell all in one lot or in lots of 150,000,000 feet. The cut will average about 7,000 feet per acre.

HARDWOOD.—6,300 acres near Washington, La., one-half mile from railroad. Will cut 8,000 feet per acre; 4,000 feet White Oak, then Red Oak, Gum, and Ash. Bordered by navigable river; soil alluvial and very rich. **Price, \$8 per acre.**

HARDWOOD.—33,000 and 17,000 acres, bordered by Tensas and Macon Rivers. The main line of the Gould system is surveyed through this land. This is one of the best timber and land propositions in the South. Will cut 8,000 feet per acre of Oak, Ash, Gum, Pecan, and Cypress. **Price, \$6 per acre.**

LONGLEAF PINE.—17,000 acres in central part of state. Estimated cut is from 6,000 to 8,000 feet per acre. Tract crossed by two railroads. This is a new property and a bargain at the price, **\$8.50 per acre.**

SHORTLEAF PINE.—35,000 acres in central part of state, crossed by railroad. This tract will cut something over 6,000 feet per acre. It is a new property and never before offered by anyone. **Price, \$8.50 per acre.**

SHORTLEAF PINE.—24,000 acres in west-central part of state. It will cut 5,000 feet per acre of Shortleaf Pine and 2,500 feet per acre of Oak. This proposition includes a brand-new sawmill of 60,000 feet per day capacity. The tract has water and rail transportation. A very great bargain at **\$6 50 per acre, including plant.**

MISSISSIPPI

LONGLEAF PINE.—55,000 acres, with new mill and equipment. Timber will cut 300,000,000 feet. Tract is very favorably located and has splendid transportation facilities. **Price, \$650,000.**

LONGLEAF YELLOW PINE.—50,000 and 8,000 acres of Longleaf Yellow Pine. This is a fine tract of pine near the N. O. and N. E. R. R. Will cut 10,000 feet per acre of Longleaf Yellow Pine. Lies in comparatively compact body. Price of the 40,000 acres, **\$25** per acre in fee-simple; of the 8,000 acres, **\$16** per acre in fee-simple.

LONGLEAF PINE.—25,000 acres on railroad. Guaranteed to cut 8,000 feet per acre. Also sawmill and full equipment. **Price, \$450,000.**

LONGLEAF PINE.—10,000 acres. Will cut 8,000 feet per acre. One-half has been turpented. **\$9** per acre for that which has been turpented, **\$11** per acre for that which has not.

HARDWOOD.—38,760 acres, lying between the Yazoo and Sunflower Rivers, both navigable and here only ten miles apart. The Yazoo & Mississippi Valley Railroad crosses one corner of the tract. This tract is claimed by timber experts to cut 7,000 feet per acre of the usual hardwoods of this locality—oak, hickory, gum, ash, etc. **Price, \$7.50 per acre.**

HARDWOOD.—6,000 acres within one mile of railroad. Estimated to cut 5,500 feet poplar, hickory, and white oak. **Price, \$9 per acre.**

HARDWOOD.—10,000 acres on new railroad. Estimated to cut 5,500 feet per acre, poplar and white oak. Land very rich, worth \$20 per acre for farming when timber is removed. **Price, \$11 per acre.**

HARDWOOD.—44,000 acres hardwood. Will cut 9,000 feet per acre, white and red oak, hickory, ash, gum, and cypress. Railroad runs through this tract. **Price, \$7.50 per acre in fee-simple.**

HARDWOOD.—100,000 acres hardwood on Yazoo & Mississippi Valley Railroad and Sunflower River. Virgin forest—oak, ash, gum, and cypress. Will cut 9,000 feet per acre. **Price, \$10 per acre.**

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70,000 ACRES PINE, CYPRESS, JUNIPER, ASH, AND GUM TIMBER in Eastern North Carolina. This property is located on two sounds which empty into the Atlantic Ocean, 100 miles south of Norfolk, Va. Exceptional water transportation facilities. The longest haul to water will not exceed four miles, and would require railroad and steam skidder. The timber is estimated by a practical timber expert to cut the following amount of merchantable lumber: 85,000,000 feet of Short Leaf N. C. Pine, 100,000,000 feet of Juniper, 15,000,000 feet of Cypress, 100,000,000 feet of Black and Sweet Gum. The timber rights on the above will be sold for less than one dollar per thousand, with ample time to remove same, or can be purchased in fee, together with 80,000 acres additional, suitable for game preserve or farming purposes, at a very small cost. This is probably the best investment in North Carolina for the money.

HARDWOOD.—20,000 acres of hardwood in Macon county. Will cut 8,000 feet. Six miles from railroad, now being built. **Price, \$5.00 per acre.**

HARDWOOD.—12,000 acres. Virgin forest of poplar, white oak, red and chestnut oak, hemlock, and some white pine. 1½ cords tan bark per acre. This property is at present 14 miles from the railroad, but the Southern Railroad is now building a branch which will pass through this tract. Will cut from 12,000 to 15,000 feet per acre, on a conservative estimate. **Price, \$7.50 per acre.**

12,000 acres in the southern part of state. Will cut 42,500,000 feet of timber, mostly Longleaf Pine, with some White Oak, Cypress, and Poplar. This tract has splendid transportation facilities. **Price, \$6 per acre.**

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500,000,000 FEET OF CHOICE STANDING TIMBER.—In South Carolina, convenient to transportation both by rail and water, near tide water possessing fine harbor.

GROUP A.—Consists of 11,000 acres, estimated to cut 25,000,000 feet of cypress, as choice as grows in the South; 18,000,000 feet excellent short-leaf pine, 5,000,000 feet of cottonwood, 8,000,000 feet of oak, 3,000,000 feet of ash, balance of timber hickory, sycamore, elm, gum, etc.

GROUP B.—22,000 acres, estimated to cut 80,000,000 feet of choice cypress, 70,000,000 choice short-leaf North Carolina pine, balance of timber oak, ash, hickory, sycamore, gum, etc.

GROUP C.—14,000 acres, estimated to cut 30,000,000 feet of choice cypress, 15,000,000 of oak, 15,000,000 short-leaf pine, 8,000,000 cottonwood, 10,000,000 ash, balance hickory, sycamore, elm, gum, etc. If the above tracts are purchased outright the timber will cost less than one dollar per thousand.

13,000 acres on railroad and navigable river. Will cut 70,000,000 feet of Cypress and 30,000,000 feet of Pine, all virgin timber. The greatest bargain in the state at **\$6 per acre.**

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COAL LAND.—3,000 acres Jellico coal land on main line of C. N. O. & T. R. R. in Kentucky, near Tennessee line. Mines are now paying net profit of \$1 per ton to owner, and will pay more. Further particulars on application.

VALUABLE SLATE QUARRY.—We have for sale a valuable property in East Tennessee, containing over 2,000 acres of excellent timber land; in addition, however, to the timber there is upon the tract a deposit of remarkably fine slate. The slate is easily and cheaply quarried—splits thin, straight and smooth, and punctures without scaling. After thorough tests the best experts have pronounced it equal to any slate in the United States. The quantity seems to be inexhaustible.

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HARDWOOD.—20,000 acres hardwood, estimated to cut 8,000 feet per acre. Poplar, oak, lynn, chestnut, etc. **Price, \$9 per acre.**

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PINE.—50,000,000 feet Pine stumpage, south Texas. Splendid location for a mill. This tract of Pine is well blocked up and is nearly in a solid body, located within 20 miles of Beaumont, on one railroad and within 2½ miles of another.

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SPECIAL, 20,000 ACRES OF TIMBER.—Spruce and hemlock; one-half will cut 20,000 feet to the acre, balance 12,000 feet. Modern sawmill, daily capacity 50,000 feet; planer, docks, trams, etc.; 10 miles standard gauge railroad, with engine, cars, steam loader, and skidder; 8 miles additional graded, with ties and rails on ground ready to lay. Storehouse, dwellings; in short, a modern lumber plant in daily operation on railroad, with good connections east and west. Apply for further particulars.

WEST VIRGINIA—Continued

COAL LANDS.—10,000 acres coal lands, convenient to railroads; three veins, one 4½ feet thick, and without slate. Cheap. Send for particulars.

TIMBER INVESTMENTS:—8,000 acres spruce and hemlock, on railroad; will cut 20,000 feet per acre. **\$35 per acre.**

1,500 acres spruce and hemlock, 2 miles from railroad; will cut 25,000 feet per acre. **\$37 per acre**

54,000,000 feet fine timber, on tract of 5,500 acres on Greenbrier River and C. & O. R.R.; will cut 20,000,000 hemlock, 10,000,000 white oak, 7,000,000 red oak, 8,000,000 chestnut oak, 1,000,000 white pine, and 8,000,000 poplar, birch, chestnut, linden, hickory, locust, etc. Profits on tan bark alone will pay for the land. **\$18 per acre.**

COAL, IRON, OIL, AND TIMBER LANDS.—7,000 acres on main line Norfolk and Western. Coal developed already; timber worth \$88,000; complete prospectus furnished.

2,200 ACRES (coal and timber) **HEMLOCK, SPRUCE, CHERRY, AND ASH.** Will cut 18,000 feet per acre. One-half is Hemlock, balance principally Spruce. This tract is on the railroad and a navigable river, is magnificently timbered and underlaid with a Clarion seam of coal. The outcrop showing plainly over the property. It has not been developed as yet, the branch of the Wabash having but recently been completed. **Price, \$40 per acre.**

2,000 ACRES, containing Hemlock, Spruce, Cherry, Ash, etc. One-half of this tract will cut 20,000 feet per acre. Balance will cut 15,000 feet per acre. This is a splendid timber proposition. Is on a railroad. Good ground for stocking. **\$32 per acre.**

1,200 ACRES, containing Hemlock, Spruce, and Cherry. This tract is one mile from railroad. Will cut 18,000 feet per acre. **\$28.**

19,000 ACRES OF **HEMLOCK AND SPRUCE**, in Pocahontas county, W. Va., being on a navigable river and also railroad. This tract is claimed to be the finest tract of Spruce and Hemlock in W. Va., and has been estimated to cut 15,000 feet per acre of Hemlock and Spruce, besides a large quantity of Ash, Cherry, Bass Wood, and Maple, not included in this estimate. With the exception of about two thousand acres, the whole tract can be lumbered at one operation. The ground is smooth and in excellent shape to operate. **Price, \$30 per acre.**

2,500 ACRES OF **TIMBER** on both sides of a navigable river, located on two lines of railroad. Will cut 8,000 feet per acre; 3,000 feet Oak per acre. This is a good, desirable property and is accessible, as aforesaid, to two railroads, which is an item in shipping lumber. **Price, \$15 per acre.**

8,000 ACRES **SPRUCE AND HEMLOCK**, on railroad. Will cut not less than 20,000 feet per acre. It is situated in the county of Randolph and lies for several miles on the railroad and a navigable river. There is a splendid lot of bark on this tract, and it will eventually pay the purchase price of land. This is one of the very best propositions we know of in Spruce and Hemlock. **Price, \$35 per acre.**

1,500 ACRES. It is located about two miles from railroad, and except for the fact that it is not directly on the railroad the description is the same as preceding property, but if possible it is slightly better timbered. **Price, \$37 per acre.**

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DEPARTMENT OF THE INTERIOR, U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C., APRIL 30, 1904. Sealed proposals, in duplicate, will be received until 2 o'clock p. m., July 2, 1904, at the office of D. W. Ross, Engineer U. S. Geological Survey, Boise, Idaho, for the construction and completion of a dam, spillways, canal, and gates, involving about 280,000 yards of rock work and 156,000 yards of earthwork, on Snake River, near Minidoka, Idaho. Specifications, forms of proposal, and particulars may be obtained on application to D. W. Ross, Boise, Idaho, and to the Chief Engineer, U. S. Geological Survey, Washington, D. C., at which offices the plans may be inspected. Each bid must be accompanied by a certified check, payable to the order of the Secretary of the Interior, for two per cent of the contract price, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of 20 per cent of the contract price for the faithful performance of the work. The right is reserved to reject any and all bids, and waive technical defects if the interests of the Government require it. Bidders are invited to be present. THOS. RYAN, Acting Secretary.

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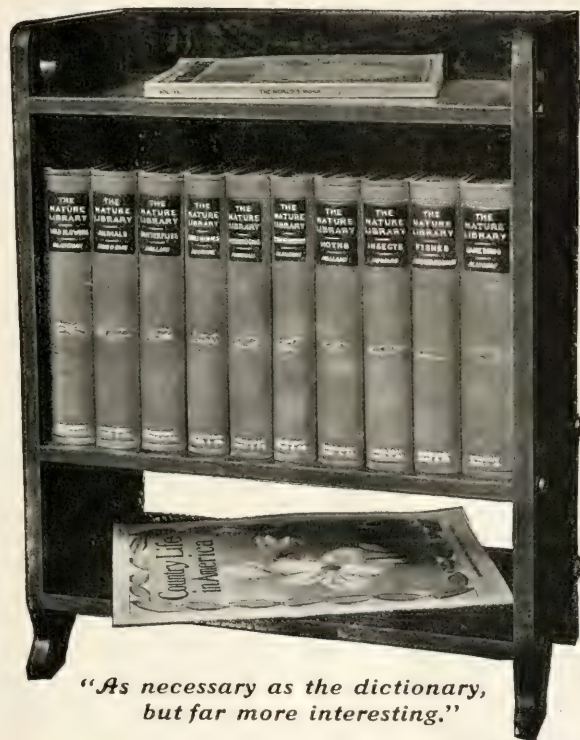
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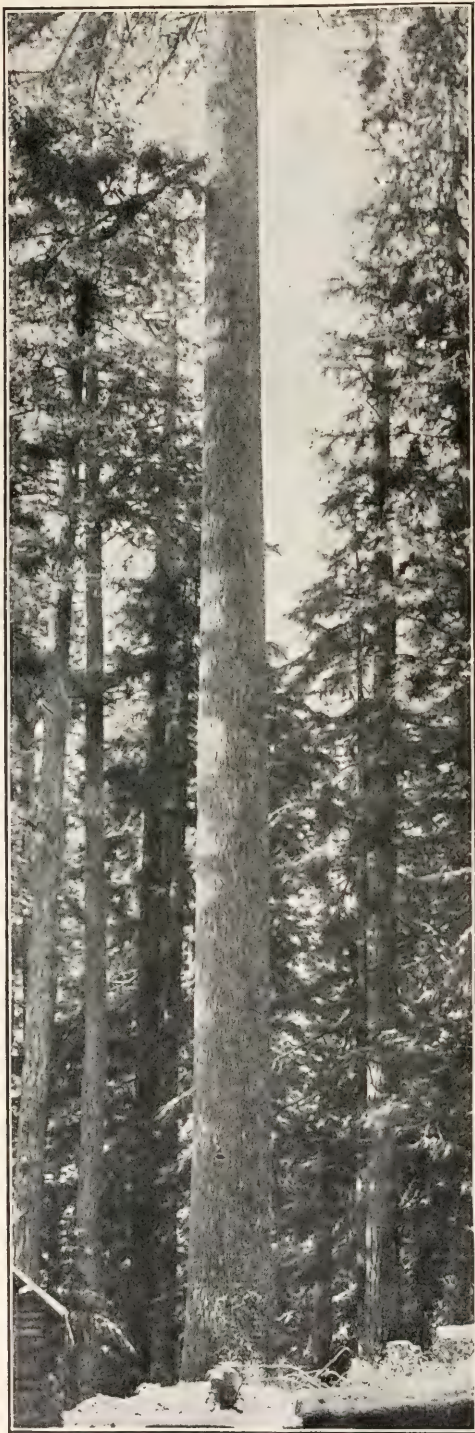


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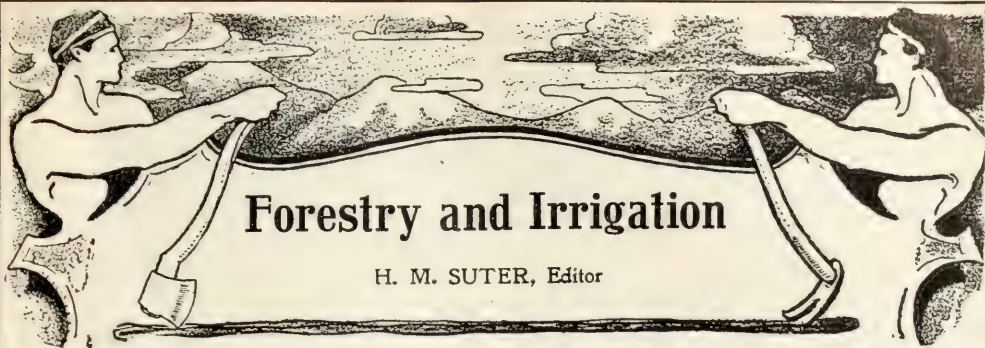
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Forestry and Irrigation.

VOL. X.

JUNE, 1904.

No. 6.

NEWS AND NOTES.

Colorado River Project. Mr. F. H. Newell, Chief Engineer of the U. S. Reclamation Service, recently left Washington for Yuma, Arizona, to begin the investigation of conditions along the Colorado River, in accordance with the resolution of Congress, introduced by Senator Bard, directing the Secretary of the Interior to institute an investigation and prepare a report to Congress on the various questions involved in connection with the use of the waters of the lower Colorado River.

He is accompanied by Mr. William C. Pollock, one of the assistant attorneys detailed from the office of the Assistant Attorney General for the Interior Department. There will also be at Yuma Mr. J. B. Lippincott, Supervising Engineer for California; Morris Bien, of California, the legal adviser of the Reclamation Service; also other engineers and experts in various lines. It is probable that Senator Bard will join the party at some point in southern California.

From Yuma the party will proceed to Imperial and, after a brief examination of the conditions, will go to Los Angeles, and there consider the preparation of a report to the Secretary.

Hawaii Favors Forestry. Resolutions strongly favoring the consolidation of all government forest work under the control of the Bureau of Forestry, and applauding the policy of that Bureau, and with recommendations looking to the preservation of the forests, were adopted on April 28 by the Honolulu Chamber of Commerce. The resolutions favor a more adequate system of fire patrol on government preserves, suggesting the advisability of detailing United States

troops for that duty during the season of danger. The policy of the Bureau of Forestry is heartily indorsed and confidence expressed in its officers as to their judgment in the selection of areas for the establishment of reserves. The resolutions strongly advocate that that part of federal forest work now under the jurisdiction of the General Land Office and the U. S. Geological Survey be transferred to the control and management of the Bureau of Forestry. The resolutions are, in effect, a complete and hearty indorsement of the present plans and future aims of the Bureau, and in text and meaning are nearly identical with those recently adopted by the Denver Chamber of Commerce and Board of Trade. The adoption of these resolutions is a good sign. It indicates the awakening of the solid, substantial business people to a realization of the importance of forestry, and the indorsement of its aims by such a class of citizens is an excellent sign.

Yale Summer School. The fourth annual session of the Yale Summer School of Forestry will open on July 1 at Grey Towers, the estate of Mr. James W. Pinchot, near Milford, Pike county, Pa. Prof. J. W. Toumey is director of the school, with Prof. Arthur H. Graves as instructor and Professors William H. Brewer, H. S. Graves, and Gifford Pinchot as special lecturers. A number of additional lectures will be given by persons as yet not designated. As stated in the prospectus of the school, the courses are arranged with a view of providing instruction in forestry to those who do not wish to take, or who are not yet ready for, the more advanced technical courses at the regular forest schools. The courses include instruction in for-

est botany, silviculture, forest mensuration, introductory lectures in forestry, forest protection, research work in forestry, forest policy of the United States, forest influences, and forest regions of the United States. Practical work in the field will supplement each course, and frequent excursions in the woods will be made with a view of familiarizing the student in the identification of tree species.

Agricultural Lands in Forest Reserves. A recent letter to the editor contains an excellent point on the subject of the disposition that should be made of the small bits of agricultural lands included in the government forest reserves. The writer is fully qualified to speak and we republish his letter in full:

"I noted with interest in the last issue of FORESTRY AND IRRIGATION the paragraph on 'Agricultural Land in the Forest Reserves.'

"The arguments presented are good, but in the reserves of the Sierra Nevada, and I think elsewhere, there is another strong reason why the small parks and open valleys should not be excluded from the reserves. It is that many of these grassy areas are a necessity to the rangers as grazing ground for their horses.

"In the mountains the question of horse feed is a vital one to every man who rides the range, and the task of finding sufficient grass for his saddle and pack animals is a difficult one for many rangers. If the mountain meadows and parks are excluded from the reserves and come into private hands, or the range cattle are allowed to graze on them unrestricted, the ranger is liable to find himself after a hard day's ride without feed for his horses. To 'pack' hay or grain enough is impossible because of the excessively high prices for such supplies in the mountains and the distance they must be carried. The only resource for the ranger is to 'stake' or 'hobble' his animals every night in some mountain meadow; hence the necessity of preserving these grassy feeding grounds.

"As to this working hardship to pros-

pective settlers, it is all idle talk, because not one mountain park in fifty can be made to support a family, and to settle on them means starvation unless other means of livelihood are at hand. The deserted cabins and abandoned home sites in the mountains attest to the futility of attempting to develop these small isolated patches of so-called agricultural land."

The Benefits of Irrigation. Chief Engineer Newell has received an interesting communication from a well-known citizen of Montana, giving a brief description of the results which followed the construction of an irrigation ditch in the vicinity of Missoula.

In 1900 a tract of land containing 2,185 acres was purchased, upon which at that time four families were residing and having a hard struggle to make a living. An irrigation system costing about \$5,000 was constructed, the laterals covering about 480 acres. As soon as the water was turned in the ditch this land was put on the market at \$200 per acre, on five years' time, the purchaser paying 10 per cent of the purchase price down and the balance in 60 equal monthly payments. There was no difficulty in disposing of the land at this price.

Some of the owners of five-acre tracts are now getting as much as \$1,500 each year from the sale of the products of their farms. Last year 10 acres of this land sold for \$3,300, the same tract having been sold for \$2,000 in 1901.

The success of the first ditch was so pronounced that another and larger irrigation system, costing \$1,900, was constructed to reclaim the balance of the tract. It has practically all been sold at from \$150 to \$200 per acre since the ditch was finished. As an illustration of what water will do on Montana land, this is probably as good an example as can be furnished.

In 1900 there were but four farms of 2,185 acres. Today there are 400 families living in prosperity and content and deriving a comfortable living from the cultivation of tracts which in other sections of the country would not be considered as fair-sized gardens.

In the Yakima Valley. Chief Engineer Newell has directed that a careful investigation be

made of the Yakima Valley, with a view of ascertaining if there is a feasible reclamation project in that district. Resident Engineer Noble, at Spokane, has instructed Assistant Engineers Bliss and Harley to begin a reconnaissance of the valley and prepare a report upon the physical conditions, the stream measurements, and the available dam sites at the proposed reservoirs at the head waters of the Yakima River.

Congressman Jones has been very earnest in urging upon the Department the importance of making this investigation.



Reclamation of Central Oregon. At the request of Senator Mitchell, a reconnaissance party will proceed late in June to

make an investigation of the central part of Lake county, Oregon, with a view to ascertaining whether there is a feasible location for the construction of a large irrigation work by the government.

Senator Mitchell describes this district as having a fine climate, where all cereals, fruits, and vegetables that are cultivated in any part of Oregon grow abundantly, and where there is a large body of fine agricultural land. The Chewaucan River, which flows through this section of the county, is reported to furnish an ample supply for the reclamation of nearly, if not quite all of these lands.

It has been reported to Senator Mitchell that reservoir sites can be secured to hold the flood waters at different points along the stream. As Lake county has contributed probably as much as any other county in the state to the arid-land fund, the citizens of that district are exceedingly anxious that this project shall receive early consideration.



Favor Malheur Project. Chief Engineer Newell, of the U. S. Reclamation Service, has received a letter from Ira S. Smith,

Vale, Oregon, President of the Malheur

County Board of Trade, in which he assures the Department that the citizens of the valley are very enthusiastic over the prospect of the early completion of the Malheur Project.

He states that they are ready and anxious to assist in the adjustment of all existing water rights which are likely to conflict with the government plans, and offers to coöperate in every possible way in order to secure the early commencement of the government work.



Public Notice.

The Secretary of the Interior has issued the following public notice regarding lands embraced in the ceded portions of the Crow Indian Reservation in Montana:

Warning is hereby given to all persons against trespassing upon the ceded portion, or any other portion, of the Crow Indian Reservation, Montana. By act of Congress approved April 27, 1904 (Public, No. 183), the agreement with the Indians of said reservation, dated August 14, 1899, providing for the cession of the northern portion of their said reservation, was ratified, with amendments, and provision made for the manner of the disposal of said land. It is provided (1) that the survey and subdivision of said ceded lands shall be completed; (2) that allotments of land shall be made to the Indians residing on said ceded portion, or, if they elect to remove to the diminished reservation, that their improvements shall be appraised and sold; and (3) that it shall be ascertained by the Secretary of the Interior what feasible irrigation projects may be found within said tract, and that the lands required for such projects shall be withdrawn for reclamation and disposition under the provisions of the reclamation act of June 17, 1902.

Thereafter, in accordance with the provisions of said act of April 27, 1904, the lands not withdrawn for such irrigation projects, and not allotted or otherwise disposed of, shall be opened to settlement by proclamation of the President, "which proclamation shall prescribe the manner in which these lands may be settled upon, occupied, and en-

tered by persons entitled to make entry thereof, and no person shall be permitted to settle upon, occupy, or enter any of said lands, except as prescribed in such proclamation, until after the expiration of sixty days from the time when the same are opened to settlement and entry."

This provision of law is clear and specific as to the time when prospective settlers may go upon said ceded lands, and all prospective settlers are therefore warned not to go thereon, under any circumstances, prior to the date hereafter to be fixed and determined. Any person violating this provision of law will be dealt with as a trespasser, in accordance with the statutes of the United States applicable thereto. No prior rights can be acquired by persons going upon the lands in advance of the date fixed, and when the same come to be opened no preference will be given to such illegal entrymen, regardless of any previous settlement or location; on the contrary, their trespass is liable to work to their disadvantage when the lands are actually opened.

Work of Yale Seniors. The Senior Class of the Yale Forest School is at Milford, Pennsylvania, for the concluding months of the course, in accordance with the regular plan of the school. The students have been hearing lectures and taking practical work in forest mapping from Mr. Austin Cary, of Maine, and in fish culture and game preservation from Dr. Barton W. Everman, of the Fish Commission, in addition to the continuation of the regular courses. The object of moving the work in the spring to Milford, which is the site of the Yale Summer School of Forestry, is to afford opportunity for field work, which could not be carried out so effectively at New Haven.

Dr. Rothrock Resigns. Readers of FORESTRY AND IRRIGATION will regret to learn that owing to ill health Dr. J. T. Rothrock has tendered his resignation to Governor Pennypacker as State Forestry Commissioner of Pennsylvania.

The resignation was immediately accepted, and Robert S. Conklin, of Columbia, was appointed Commissioner. Mr. Conklin is the present Deputy Commissioner, and he has been actively connected with the state forestry work in Pennsylvania for several years.

Dr. Rothrock has been the leader of forest movement in Pennsylvania, and has been connected with the Forestry Commission since it was created. He has served as Forestry Commissioner under four governors, and to his unusual devotion to duty much of the state's advance in forest matters is directly traceable.

An English Forest School. Some insight into English methods of forestry education is obtainable from the following account of Dean Forest School, reprinted from the *London Leader*:

"The school of forestry started by the Commissioners of Woods and Forests at Coleford, in the Forest of Dean, is proving a great success.

"When the Departmental Committee appointed by the Board of Agriculture to inquire into the state of British forestry reported at the end of 1902, the Commissioners of Woods and Forests took up the question of education for foresters and woodmen.

"The claims of the Forest of Dean had been strongly urged by Sir Charles Dilke, the member for the division, as against Alice Holt Woods in Hampshire, and the Commissioners chose Dean Forest for a school. It had the additional advantage of having been worked for the last six years under a scientific plan prepared by the late Mr. Hill, head of the Indian Forest Department.

"Class-room accommodation was found at the Crown offices at Coleford for 20 students, and the services of Mr. C. D. Hanson, of the Indian Forest Department, were obtained as instructor. It was decided to start with a small class only at first, and the school was opened in January last with 9 students. The first three months' working is considered very satisfactory.

"The students are all in the employ of the Crown, 7 being from Dean Forest and 2 from Windsor Forest. Classes are held two days a week, the students working in the woods the remainder of the time. Their ages vary from 17 to 22, and they receive from 12s. to 18s. a week.

"The education is free, and no deduction is made from wages. The full course will extend over two years. Instruction will be given in all branches of forestry, theoretical and practical, including choice of soils and situations to grow the more important British forest trees; the method and treatment for each species, and the best methods of sowing, planting, thinning, and pruning to produce sound timber. The students will be taught to recognize the more important fungi and insects, and the means of prevention and cure.

"Such operations as measurement and valuation of timber and standing woods will be dealt with, and the system of management to produce annual yield explained. In view of the thorough training they will get, there should be no difficulty in the students obtaining good situations, as the supply of trained foresters is limited, and many landowners complain of the difficulty of getting them.

"It is hoped to start a second class next year, and it may be possible to arrange to receive men from private estates, but it will be impossible for the Crown to take more than a limited number of paid workmen, as sufficient employment could not be found for them in the woods."



Manufacturers Favor Forestry and Irrigation.

The annual convention of the National Association of Manufacturers, held at Pittsburg in May, showed a notable

interest among the delegates in the subjects of forestry and irrigation. Mr. George H. Maxwell, executive chairman of the National Irrigation Association, was invited to address the convention, and his remarks created a most favorable impression.

The association appointed a standing

Committee on Irrigation and passed a series of significant resolutions. These resolutions strongly urge that Congress should repeal the desert act and the commutation clause of the homestead act. They also urged the national government to proceed as rapidly as possible with its work of reclaiming the arid public lands. Strong indorsement is contained in these resolutions of the recommendation of the Secretary of the Interior and the Public Lands Commission appointed by President Roosevelt for the repeal of the timber and stone act. The resolutions further urge that all public forest lands should be embraced in the permanent forest reserves. It was the unanimous opinion of the association that all forestry work of the national government should, as recommended by President Roosevelt, be consolidated in the Bureau of Forestry of the Department of Agriculture.



Forestry Session of Women's Clubs.

May 24 was set aside at the general federation biennial of Women's Clubs at St.

Louis as a forestry session, and reports on the progress of forest protection from members representing standing committees in thirty-four states were present and engaged in discussion. Mrs. L. P. Williams was in the chair, and spoke of progress made in Minnesota through the instrumentality of the Morris act. She also addressed the meeting on the subject, "Can Woman Through Organization Influence Legislation in Favor of Forestry?" Miss Mira L. Dock, a member of the Pennsylvania Forest Commission, was present, and spoke on "Ten Years of Forestry." The gain in growth of the idea of forest protection among women's clubs is evidenced by the remarkable increase in committees devoted especially to the work. The federation, after two years, now has standing committees enrolled from thirty-four states that are enthusiastically spreading the propaganda of tree planting and forest preservation, both of which are included in the scope of the department. The remarks of delegates were interesting, inasmuch as they

gave an idea of the working methods of the department. Trees and cuttings have been planted; insects injurious to trees have been exterminated; new species of trees introduced; forest reserves advocated, and general measures looking to the preservation of the forests suggested. The women's clubs are doing a great work in the spreading of information relating to the tenets of forestry and its teachings.



Forest Fire Record.

Following the meager reports of more or less incipient forest fires, as mentioned in the May number of FORESTRY AND IRRIGATION, come advices of fires of increasing gravity, principally from sections in which a dry spring has favored their spread. Locomotive sparks have been an additional accessory and in many cases added to their impetus. The states of Wisconsin, Minnesota, and Michigan have experienced such a spring, and, judging from newspaper reports, the first named has suffered severely. Several houses were lost in the vicinity of Rhinelander and Wittenberg, a number of barns have been burned, and several hundred cords of wood and much live stock were destroyed. In Bayfield county, as late as May 30, damage was reported from fires which in one instance threatened the destruction of a small town, Cornucopia. Along the line of the Michigan and Wisconsin railroad and the Soo line much apprehension was felt, owing to the threatened destruction of large quantities of cedar timber and ties piled along the roads in the fire zone. More loss has been occasioned through destruction of buildings, crops, cut timber, and live stock, however, than to standing timber, as the lands burned over were of little worth. In Minnesota several small fires were reported in the vicinity of Eveleth, but no great amount of damage was inflicted. Near Menominee, Michigan, forest fires destroyed considerable cut timber. In Arizona the rangers of the Black Mesa Forest Reserve had to fight an incipient blaze which traveled several miles. Forest fires in the Mogollon Moun-

tains, in the Gila River Forest Reserve in New Mexico, demanded some attention from rangers on May 18, but, owing to immediate fire-fighting, no serious damage was done to the fine timber in the heart of the Mogollons, as was at first anticipated. High winds favored the progress of a number of small but destructive fires in the Blue Ridge Mountains of Virginia, in Rappahannock county, and North Carolina also experienced forest fires of a minor character near Castle Haynes. In New Jersey press reports indicate the destruction of a number of houses and several cranberry bogs in the vicinity of Doughty's Tavern, and several scattered fires have burned over valuable woodland. In Pennsylvania, near Bloomsburg, a large amount of standing timber was burned in a fire started presumably from locomotive sparks.



Connecticut Forests.

The work which the Connecticut Forestry Association is doing in protecting the forests of the state and in having the waste lands of Connecticut utilized by forest growth was explained by Walter Mulford, the state forester, at the annual meeting of the association, held at Hartford recently.

The state forest in the town of Portland contains 900 acres, which was bought at an average price of \$1.65 an acre. The first appropriation by the state was \$2,000 in 1901. All but 6 cents of this appropriation has been spent, and the appropriation of \$2,000 made in 1903 is being utilized. The state forest in Portland is being used to show people the method of treating woodland in raising a crop of timber and to induce private owners of woodlands to give them better care by showing them that it is profitable to do so. The future work on the state forest will be in the nature of thinning out the trees to obtain a better growth and the sowing of chestnut, oak, and pine.

The state forestry association has recently notified the granges of the state that lectures on the subject of forestry will be furnished without expense, and the association proposes to secure some

form of law for the protection of forests from fires.

President—Walter Mulford, of Windsor.

Vice-presidents—Henry Ferguson, of Hartford; T. S. Gold, of West Cornwall; Willis I. Twitchell, of Hartford.

Secretary—Everett S. Geer, of Hartford.

Corresponding secretary—Miss Mary Winslow, of Weatogue.

Treasurer—Alfred Spencer, Jr., of Hartford.

Auditor—Appleton R. Hillyer, of Hartford.

Advisory board—The above officers and Major E. V. Preston, P. Henry Woodward, John L. Denison, and Rev. John T. Huntington, Hartford; George Griswold, Old Lyme; Mrs. Jessie B. Gerard, South Norwalk; Dr. E. H. Jenkins, Edward A. Bowers, and Alfred Ackerman, New Haven; E. K. Hubbard, Middletown; Robert Scoville, Chappinville.



Additions to Reclamation Service.

Thomas H. Means, engineer of soils, and Thomas F. J. McGuire, electrical expert, have

joined the Reclamation Service and are detailed upon important work in the West. Mr. Means, who was, until his transfer, connected with the Bureau of Soils, Department of Agriculture, was in charge of the United States Soils Survey, and was particularly expert in alkali problems and in reclaiming alkali lands. Two years ago he made a trip to Egypt to study reclamation matters there in relation to our own questions, and is now recognized as the foremost expert on alkali soils in this country. His services will be called on in the designing of plans for establishing systems of drainage in connection with irrigation works and for making classifications of soils in the sections to be reclaimed. His new position will offer even a better field for his work than his former one, and he will have a better chance to make his services valuable to the sections of country in which he works.

Mr. McGuire, who is an expert in electric installation, will assist in super-

vising the placing of power plants at the various reservoir and dam sites in the West, such as the one contemplated at the Tonto works in Arizona, where it is proposed to develop electricity for general power purposes, and particularly for pumping, in connection with the distribution of water.



New Forest Reserves.

Four new forest reserves have recently been created by proclamation of

President Roosevelt. The entire area represents an acreage of 245,920 in Utah and South Dakota. On March 5 two reserves were set aside in Butte county, S. Dak., designated respectively the Cave Hills Forest Reserve and the Slim Buttes Forest Reserve. Captain Seth Bullock, superintendent of the Black Hills Forest Reserve, has been placed in charge. On May 7 the Grantsville Forest Reserve, in Utah, was established, with an area of 68,960 acres, and on May 26 an area of 95,440 acres in the same state was reserved under the name of the Salt Lake Forest Reserves. In addition to these changes in the area of the government's forest reserves, several reductions and additions have been made to existing reserves. The most important of these have been: May 2, the Fish Lake Forest Reserve (Utah), addition of 131,200 acres, making the present area 199,040 acres; May 4, Yellowstone Forest Reserve (Montana and Wyoming), reduction of 518,600 acres, leaving present area 7,810,600 acres; May 16, Battlement Mesa Forest Reserve (Colorado), reduction of 45,440 acres, leaving the present area 807,560 acres; May 21, White River Forest Reserve (Colorado), reduction of 259,040 acres, leaving present area 970,880 acres. The total combined area of the forest reserves is at present approximately 62,700,000 acres.



Examination of Forests.

Thus far in the season Mr. Henry Gannett, geographer of the U. S. Geological Survey, has ordered only two parties into the field for the examination of forests and the classification of lands.

One party, consisting of Messrs. Fred G. Plummer and M. G. Gowsell, is examining the Santa Barbara Reserve, in California. On completing that work they will turn their attention to the mountains in the neighborhood of San Luis Obispo, in the same state. The second party, under Mr. T. F. Rixon, is examining the mountains southwest of Albuquerque, New Mexico. This land has been reserved, and the examination is made in order to determine whether it would be advisable to create there a forest reserve.



Kansas Horticultural Society Meeting.

Nearly all of the papers announced in our last issue as being on the program for the Kansas State Horticultural Society's meeting at Dodge City, on May 11 and 12, were presented, and many good points concerning forest growing in western Kansas were developed in a most successful meeting. A committee was appointed to recommend plans aiding the Bureau of Forestry in Kansas and increasing the efficiency of the state forestry work. This committee is to report at the annual meeting of the society next December, and it is hoped that its report will eventually lead to much more effective forest work by the state, as well as more active co-operation with the Bureau of Forestry.



Forest Reserve Personals.

Mr. Charles McNaughton has reentered the Forest Service as a ranger on the Gila River Forest Reserve.

Head Ranger Charles H. Shinn has been promoted to forest supervisor and placed in immediate charge of the field work of the northern division of the Sierra Forest Reserve.

Forest Ranger Roger S. Baldwin, who has been attending the Yale Forest School, has resumed his duties on the eastern division of the Santa Barbara Forest Reserve.

James H. Clarke, of Denver, Colorado, has been appointed forest supervisor of the Pike's Peak group of forest reserves of Colorado, to fill the vacancy caused by the death of former Supervisor Michelsen.

James G. Thain, of Montana, has been appointed forest supervisor of the Highwood Mountains Forest Reserve, Montana, with headquarters at Highwood, Montana.

Mr. A. M. Bliss, of Montana, has been appointed forest supervisor of the southern division of the Lewis and Clarke Forest Reserve.

Mr. Adolph Aschoff, who has been serving as first-class ranger on the northern division of the Cascade Range Forest Reserve, has been promoted to forest supervisor of this division, to take effect June 1.

Milton J. Anderson, of the same reserve, has been promoted to first-class ranger.

Mr. Charles A. Ballinger has been appointed forest ranger, to serve on the Cave Hills Forest Reserve in South Dakota, under Supt. Seth Bullock.

Forest Ranger L. T. Mazzanovich has been transferred from the Yellowstone Reserve, Wyoming, to the High River Forest Reserve in Montana.

Special Forest Supervisor A. A. Anderson, who is in charge of the Yellowstone Forest Reserve, has returned to Wyoming to engage in active field duties.

Forest Ranger G. B. Coleman, who has been acting as officer in charge of the western division of the Washington Forest Reserve, has been promoted to forest supervisor of this division, to fill the vacancy caused by the resignation of Mr. R. S. Lambert.

Forest Ranger George W. Millham, who has been employed as forest ranger on the eastern division of the Washington Forest Reserve for the past four years and recently acting as officer in charge thereof, has been promoted to forest supervisor, to fill the vacancy caused by the death of Forest Supervisor P. H. Farley.

Mr. H. D. Langille has been reinstated forest inspector, and is now in the field.

Mr. George H. Barney has been appointed forest superintendent of the recently created Aquarius Forest Reserve of Utah, with headquarters at Escalante.

Samuel S. Terrel has been appointed forest supervisor of the Baker City Forest Reserve in Oregon.

AMERICAN LUMBERMAN, CHICAGO. I HAVE BEEN PROMOTED TO FIRST CLASS RANGER.

Warning to Homeseekers. An organized band of swindlers is actively at work in several western states, notably Utah, North and South Dakota, and also operating to a lesser extent in the East. These sharpers have selected as easy victims prospective homeseekers who are greatly interested in the various reclamation projects undertaken by the government.

By means of advertisements cleverly worded, in which they claim to have secured inside information regarding the plans of the engineers, and by the display of alleged copies of government maps and surveys, they have been successful in duping many unwary homeseekers. For a consideration of from \$50 to \$200, these swindlers guarantee to locate settlers upon the best irrigable lands under the government works.

Notwithstanding that the government some time ago issued a circular warning the people against being taken in by just such frauds, the swindling goes right along, and the sharks are reaping a rich harvest. It should be clearly understood that these sharpers have no inside information. Their maps are mere township plats, or rough drafts, such as can be obtained from the land office. The swindlers have no data other than any intending settler can obtain upon request of the Department.

The lands under these government projects are withdrawn from all entry excepting homestead before any actual work of construction is ordered, and the Secretary is by law required to outline the size and location of each farm. Until the plans are completed for construction and the contract has been let for the works, it is impossible to state with any degree of accuracy what the cost of the water will be or what lands will be irrigated. Settlers who make filings based on the information received from these swindlers will not only lose the money paid out, but are liable later to find the lands are not included in the government's proposed system, and thus will have exhausted their homestead entry upon worthless land. When the proper time comes for throwing open to homestead entry the lands under these great irrigation projects, the Secretary

of the Interior will give due notice through the public press. Until such announcement, it will not be safe for settlers to locate upon these lands.



Study of Water Laws.

The Reclamation Service has recently received from various officials of the Western States sets of law books giving the statutes relating to the appropriation and use of water. Special studies are being made of these subjects in connection with the requirement of the reclamation law, that the work of reclaiming the arid West shall be carried on in conformity with state laws.

The legal experts of the government are devoting particular attention to the questions of law, and are advising state officials, where necessary, of conditions which may interfere with the execution of various contemplated projects.

In the States of Oregon and Washington commissions have been appointed to study the water laws, and the officials of the Reclamation Service have been invited to confer with these commissions and suggest legislation of value in the development of the state.



To Utilize Grand River.

The recent withdrawal from entry by the Secretary of the Interior of a large body of land in Colorado marks a very important step in the development of the irrigation possibilities of the Colorado River. The withdrawn areas embrace what is known as the Kremmling reservoir site in the canyon of the Grand River, the largest tributary of the Colorado.

The government engineers, finding it impossible to provide storage in the lower reaches of the Colorado for the extensive systems of irrigation they have planned, have investigated the valleys of the principal tributaries and decided upon the Kremmling as the most valuable site available. This investigation and the withdrawal which followed are only an indication of the far-sighted and practical policy which characterizes the government work of reclamation. These works are not be-

ing built for a single generation, but for all time, and every step taken is carefully considered.

The knowledge that a vast storage reservoir is to be constructed at the headwaters of the Colorado River will relieve much of the apprehension that now exists in the lower valley regarding the proposed diversion of this stream upon lands above Yuma. It will also simplify in a large measure many vexing questions which might arise between Mexico and this country over the division of the water.

A board of six consulting engineers, with Mr. J. B. Lippincott, supervising engineer of the work on the Colorado, and Mr. E. T. Perkins, engineer in charge on the ground, recently made a thorough study of the results of the surveys and investigations in the lower valley. As a result of their determination that the proper storage could not be obtained on the lower Colorado River, the recommendation for the withdrawal of the Kremmling reservoir site was made to the Secretary.

The area which can be irrigated by the proposed government works is estimated at about 2,000,000 acres. These lands are not only unusually fertile, but on account of the climate will produce crops during practically the entire year. The climate and physical characteristics of the river and the features upon which irrigation will depend partake largely of the nature of the Nile in Egypt, involving much the same problems and returning much the same products.

For the successful completion of these works the normal flow of the stream must be supplemented in midsummer by storage, for without storage of water it would not be possible to irrigate more than one-fourth to one-third of the amount of land that can be supplied with proper storage facilities.

Difficult Reclamation Problem. The Farmers' Coöperative Irrigation Association, an organization of certain farmers of Crook county, Oregon, has sent a petition to the Secretary of the Interior

bearing 300 signatures and asking that a thorough investigation be made by the reclamation engineers of the irrigation possibilities in that section of the state.

Senator Mitchell has interested himself in the matter, and has urged upon the Department an early investigation of this section. The location of the proposed work has been studied in a general way by the engineers of the Reclamation Service, and the situation has been found to be complicated by the fact that the water supply must apparently be obtained either from Crooked River, the summer flow of which is practically all appropriated, or from Deschutes River, the water supply from which must be carried across Crooked River valley at great expense.

It has been found that the lands which may be watered from Deschutes River have to a large extent been selected by the State of Oregon, and will require the greater part, if not all, of the flow of the Deschutes. The question of water rights, therefore, is a very serious one, and under the circumstances the Reclamation Service does not think it practicable for the government to go into this region while the state is attempting to reclaim large tracts under the operation of the Carey Act, or before it is definitely known what action will be taken under the contracts made with the state for the reclamation of lands along the Deschutes River.



Inyo County, California. In Inyo county, California, on the eastern slope of the Sierras, is a large area of desert public land which bears a strong resemblance to several districts in southern California. The United States Geological Survey is preparing to send a competent geologist to investigate this region with a view to the discovery of artesian water.

Mr. Willis T. Lee, now in Arizona, will probably commence an investigation early in the summer, and will publish a report on the geologic conditions of Inyo county.



MR. A. L. FELLOWS,

ONE OF THE LEADING ENGINEERS OF THE UNITED STATES RECLAMATION SERVICE.

AMONG the men who are doing notable work in the Reclamation Service is Mr. A. L. Fellows, of Denver. While he is deeply interested in the work generally, he has made a special study of irrigation conditions in Colorado, and his efforts in connection with the Uncompahgre project have done much to bring it to favorable notice. One of the most perilous and valuable pieces of exploration work done by the Geological Survey in recent years was Mr. Fellows' reconnaissance of the Grand Canyon of the Gunnison River. This undertaking made possible the present plans for the Gunnison tunnel.

Mr. Fellows was born in Kennebunk, Maine, November 1, 1864, and was educated at Yale University, where he received the degree of B. A. in 1886; commenced work in irrigation lines September, 1887, continuing for eight years in the service of the Montezuma Valley irrigation companies, and being for several years of this period superintendent of schools and county surveyor of Montezuma county, Colorado. He was also for five years deputy state engineer of Colorado. Prior to appointment as an engineer in the Reclamation Service, on January 1, 1903, he was employed at various times by the United States Geological Survey as hydrographer and topographer. Mr. Fellows is author of several papers and articles on hydrography, irrigation survey, and irrigation practice.

WILDERNESS RESERVES.*

BY

PRESIDENT ROOSEVELT.

PART I.

NOTE.—This article, with its accompanying illustrations, forms a part of the fourth and latest volume of the Books of the Boone and Crocket Club, and is reprinted here through the courtesy of the editor, Mr. George Bird Grinnell. In addition to being a remarkably entertaining sketch of wild-animal life in the United States, it is valuable as giving President Roosevelt's view of the purpose of our national parks and forest reserves. To those of our readers unacquainted with the Boone and Crocket Club, it may be well to say that its organization was due to a suggestion by Theodore Roosevelt at a dinner given by him to a few of his friends in New York in 1887—men who were also big-game hunters. The club is made up of men who use the rifle in big-game hunting, and who meet from time to time to discuss subjects of interest to hunters. In addition, the Boone and Crocket Club takes a keen interest in the preservation of the big game of the United States, and has brought about notable improvements and additions to our game laws. Mr. Roosevelt was the first president of the club, and was for many years on its editorial committee.—EDITOR.

THE practical common sense of the American people has been in no way made more evident during the last few years than by the creation and use of a series of large land reserves—situated, for the most part, on the great plains and among the mountains of the West—intended to keep the forests from destruction, and therefore to conserve the water supply. These reserves are created purely for economic purposes. The semi-arid regions can only support a reasonable population under conditions of the strictest economy and wisdom in the use of the water supply, and, in addition to their other economic uses, the forests are indispensably necessary for the preservation of the water supply and for rendering possible its useful distribution throughout the proper seasons. In addition, however, to the economic use of the wilderness by preserving it for such purposes where it is unsuited for agricultural uses, it is wise here and there to keep selected portions of it—of course only those portions unfit for settlement—in a state of nature, not merely for the sake of preserving the forests and the water, but for the sake of preserving all its beauties and wonders unspoiled by greedy and shortsighted vandalism. These beauties and wonders include animate as well as inanimate objects.

The wild creatures of the wilderness add to it by their presence a charm which it can acquire in no other way. On every ground it is well for our nation to preserve, not only for the sake of this generation, but above all for the sake of those who come after us, representatives of the stately and beautiful haunts of the wilds which were once found throughout our great forests, over the vast, lonely plains, and on the high mountain ranges, but which are now on the point of vanishing save where they are protected in natural breeding grounds and nurseries. The work of preservation must be carried on in such a way as to make it evident that we are working in the interest of the people as a whole, not in the interest of any particular class, and that the people benefited beyond all others are those who dwell nearest to the regions in which the reserves are placed. The movement for the preservation by the nation of sections of the wilderness as national playgrounds is essentially a democratic movement in the interest of all our people.

On April 8, 1903, John Burroughs and I reached the Yellowstone Park, and were met by Major John Pitcher, of the regular army, the superintendent of the park. The Major and I forthwith took horses, he telling me that he could show

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me a good deal of game while riding up to his house at the Mammoth Hot Springs. Hardly had we left the little town of Gardiner and gotten within the limits of the park before we saw prong-buck. There was a band of at least a hundred feeding some distance from the road. We rode leisurely toward them. They were tame compared to their kindred in the unprotected places; that is, it was easy to ride within fair rifle range of them; but they were not familiar in the sense that we afterwards found the

stone and in the plains south of the Golden Gate. While migrating they go over the mountains and through forests if the occasion demands. Although there are plenty of coyotes in the park, there are no big wolves, and, save for very infrequent poachers, the only enemy of the antelope, as indeed the only enemy of all the game, is the cougar.

Cougars, known in the park as elsewhere through the West as "mountain lions," are plentiful, having increased in numbers in recent years.



PRESIDENT ROOSEVELT AND MAJOR PITCHER.

bighorn and the deer to be familiar. During the two hours following my entry into the park we rode around the plains and lower slopes of the foothills in the neighborhood of the mouth of the Gardiner, and we saw several hundred—probably a thousand all told—of these antelope. Major Pitcher informed me that all the prong-horns in the park wintered in this neighborhood. Toward the end of April or the first of May they migrate back to their summering homes in the open valleys along the Yellow-

Except in the neighborhood of the Gardiner River—that is, within a few miles of Mammoth Hot Springs—I found them feeding on elk, which in the park far outnumber all the other game put together, being so numerous that the ravages of the cougars are of no real damage to the herds. But in the neighborhood of the Mammoth Hot Springs the cougars are noxious because of the antelope, mountain sheep, and deer which they kill, and the superintendent has imported some hounds with which to

hunt them. These hounds are managed by Buffalo Jones, a famous old plainsman, who is now in the park taking care of the buffalo. On this first day of my visit to the park I came across the carcasses of a deer and of an antelope which the cougars had killed. On the great plains cougars rarely get antelope but here the country is broken, so that the big cats can make their stalks under favorable circumstances. To deer and mountain sheep the cougar is a most dangerous enemy—much more so than the wolf.

The antelope we saw were usually in bands of from twenty to one hundred and fifty, and they traveled strung out almost in single file, though those in the rear would sometimes bunch up. I did not try to stalk them, but got as near them as I could on horseback. The closest approach I was able to make was to within about eighty yards of two which were by themselves—I think a doe and a last year's fawn. As I was riding up to them, although they looked suspiciously at me, one actually lay down. When I was passing them at

about eighty yards distance the big one became nervous, gave a sudden jump, and away the two went at full speed.

Why the prong-bucks were so comparatively shy I do not know, for right on the ground with them we came upon deer, and in the immediate neighborhood mountain sheep, which were absurdly tame. The mountain sheep were nineteen in number, for the most part does and yearlings, with a couple of three-year-old rams, but not a single big fellow, for the big fellows at this season are off by themselves, singly or in little bunches, high up in the mountains. The band I saw was tame to a degree matched by but few domestic animals.

They were feeding on the brink of a steep washout at the upper edge of one of the benches on the mountain side, just below where the abrupt slope began. They were alongside a little gully with sheer walls. I rode my horse to within forty yards of them, one of them occasionally looking up and at once continuing to feed. Then they moved slowly off and leisurely crossed the gully to the other side. I dismounted, walked



"OOM JOHN" (JOHN BURROUGHS).



PRONGBUCKS.

around the head of the gully, and, moving cautiously, but in plain sight, came closer and closer until I was within twenty yards, where I sat down on a stone and spent certainly twenty minutes looking at them. They paid hardly any attention whatever to my presence—certainly no more than well-treated domestic creatures would pay. One of the rams rose on his hind legs, leaning his fore-hoofs against a little pine tree, and browsed the ends of the budding branches. The others grazed on the short grass and herbage or lay down and rested, two of the yearlings several times playfully butting at one another. Now and then one would glance in my direction without the slightest sign of fear, barely even of curiosity. I have no question whatever but that with a little patience this particular band could be made to feed out of a man's hand. Major Pitcher intends during the coming winter to feed them alfalfa, for game animals of several kinds have become so plentiful in the neighborhood of the Hot Springs and the Major has become so interested in them that he wishes to do something toward feeding them during the severe winter. After I had looked at the sheep to my heart's content I walked back to my horse, my departure arousing as little interest as my advent.

Soon after leaving them we began to come across black-tailed deer, singly, in twos and threes, and in small bunches of a dozen or so. They were almost as tame as the mountain sheep, but not quite—that is, they always looked alertly at me, and though if I stayed still they would graze they kept a watch over my movements and usually moved slowly off when I got within less than forty yards of them. Up to that distance, whether on foot or on horseback, they paid but little heed to me, and on several occasions they allowed me to come much closer. Like the bighorn, the black-tails at this time were grazing, not browsing, but I occasionally saw them nibble some willow buds. During the winter they had been browsing. As we got close to the Hot Springs we came across several white-tail in an open, marshy meadow. They were not quite as tame as the black-tail, although without any difficulty I walked up to within fifty yards of them. Handsome though the black-tail is, the white-tail is the most beautiful of all deer when in motion, because of the springy, bounding grace of its trot and canter and the way it carries its head and white flag aloft.

Before reaching the Mammoth Hot Springs we also saw a number of ducks in the little pools and on the Gardiner.



MOUNTAIN SHEEP.

Some of them were rather shy, others—probably those which, as Major Pitcher informed me, had spent the winter there—were as tame as barn-yard fowls.

Just before reaching the post the Major took me into the big field where Buffalo Jones had some Texas and Flat Head Lake buffalo bulls and cows, which he was tending with solicitous care. The original stock of buffalo in the park have now been reduced to fifteen or twenty individuals, and the intention is to try to mix them with the score of buffalo which have been purchased out of the Flat Head Lake and Texas Panhandle herds. The buffalo were put within a wire fence, which, when it was built, was found to have included both black-tail and white-tail deer. A bull elk was also put in with them at one time, he having met with some accident which made the Major and Buffalo Jones bring him in to doctor him. When he recovered his health he became very cross. Not only would he attack men, but also buffalo, even the old and surly master bull, thumping them savagely with his antlers if they did anything to which he objected.

When I reached the post and dismounted at the Major's house I supposed my experiences with wild beasts for the day were ended, but this was an error. The quarters of the officers and men and the various hotel buildings, stables, residences of the civilian officials, etc., almost completely surrounded the big parade ground at the post, near the middle of which stands the flag-pole, while the gun used for morning and evening salutes is well off to one side. There are large gaps between some of the buildings, and Major Pitcher informed me that throughout the winter he had been leaving alfalfa on the parade ground, and that numbers of black-tail deer had been in the habit of visiting it every day, sometimes as many as seventy being on the parade ground at once. As springtime came on the numbers diminished. However, in mid-afternoon, while I was writing in my room in Major Pitcher's house, on looking out of the window I saw five deer on the parade ground. They were as tame as so many Alderney cows, and

when I walked out I got up to within twenty yards of them without difficulty. It was most amusing to see them as the time approached for the sunset gun to be fired. The notes of the trumpeter attracted their attention at once. They all looked at him eagerly. One then resumed feeding, and paid no attention whatever either to the bugle, the gun, or the flag. The other four, however, watched the preparations for firing the gun with an intent gaze, and at the sound of the report gave two or three jumps, then, instantly wheeling, looked up at the flag as it came down. This they seemed to regard as something rather more suspicious than the gun, and they remained very much on the alert until the ceremony was over. Once it was finished, they resumed feeding as if nothing had happened. Before it was dark they trotted away from the parade ground back to the mountains.

The next day we rode off to the Yellowstone River, camping some miles below Cottonwood Creek. It was a very pleasant camp. Major Pitcher, an old friend, had a first-class pack train, so that we were as comfortable as possible, and on such a trip there could be no pleasanter or more interesting companion than John Burroughs—"Oom John," as we soon grew to call him. Where our tents were pitched the bottom of the valley was narrow, the mountains rising steep and cliff-broken on either side. There were quite a number of black-tail in the valley, which were tame and unsuspicious, although not nearly so much so as those in the immediate neighborhood of the Mammoth Hot Springs. One mid-afternoon three of them swam across the river a hundred yards above our camp. But the characteristic animals of the region were the elk—the wapiti. They were certainly more numerous than when I was last through the park, twelve years before.

In the summer the elk spread all over the interior of the park. As winter approaches they divide, some going north and others south. The southern band, which, at a guess, may possibly include ten thousand individuals, winter out of the park, for the most part in Jackson's

Hole—though, of course, here and there within the limits of the park a few elk may spend both winter and summer in an unusually favorable location. It was the members of the northern band that I met. During the winter time they are very stationary, each band staying within a very few miles of the same place, and from their size and the open nature of their habitat it is almost as easy to count them as if they were cattle. From a spur of Bison Peak, one day, Major Pitcher, the guide Elwood Hoffer, John Burroughs, and I spent about four hours with the glasses counting and estimating the different herds within sight. After most careful work and cautious reduction of estimates in each case to the minimum the truth would permit, we reckoned three thousand head of elk, all lying or feeding and all in sight at the same time. An estimate of some fifteen thousand for the number of elk in these northern bands can not be far wrong. These bands do not go out

of the park at all, but winter just within its northern boundary. At the time when we saw them the snow had vanished from the bottom of the valleys and the lower slopes of the mountains, but grew into continuous sheets further up their sides. The elk were for the most part found up on the snow slopes, occasionally singly or in small gangs; more often in bands of from fifty to a couple of hundred. The larger bulls were highest up the mountains and generally in small troops by themselves, although occasionally one or two would be found associating with a big herd of cows, yearlings, and two-year-olds. Many of the bulls had shed their antlers; many had not. During the winter the elk had evidently done much browsing, but at this time they were grazing almost exclusively, and seemed by preference to seek out the patches of old grass which were last left bare by the retreating snow. The bands moved about very little, and if one were seen



DEER ON THE PARADE GROUND.



WHISKEY JACKS.

one day it was generally possible to find it within a few hundred yards of the same spot the next day, and certainly not more than a mile or two off. There were severe frosts at night, and occasionally light flurries of snow; but the hardy beasts evidently cared nothing for any but heavy storms, and seemed to prefer to lie in the snow rather than upon the open ground. They fed at irregular hours throughout the day, just like cattle; one band might be lying down while another was feeding. While traveling they usually went almost in single file. Evidently the winter had weakened them, and they were not in condition for running, for on the one or two occasions when I wanted to see them close up I ran right into them on horseback, both on level plains and going up hill along the sides of rather steep mountains. One band in particular I practically rounded up for John Burroughs, finally getting them to stand in a huddle while he and I sat on our horses less than fifty yards off. After

they had run a little distance they opened their mouths wide and showed evident signs of distress.

We came across a good many carcasses. Two, a bull and a cow, had died from scab. Over half the remainder had evidently perished from cold or starvation. The others, including a bull, three cows, and a score of yearlings, had been killed by cougars. In the park the cougar is at present their only animal foe. The cougars were preying on nothing but elk in the Yellowstone Valley, and kept hanging about the neighborhood of the big bands. Evidently they usually selected some outlying yearling, stalked it as it lay or as it fed, and seized it by the head and throat. The bull which they killed was in a little open valley by himself, many miles from any other elk. The cougar which killed it, judging from its tracks, was a very large male. As the elk were evidently rather too numerous for the feed, I do not think the cougars were doing any damage.



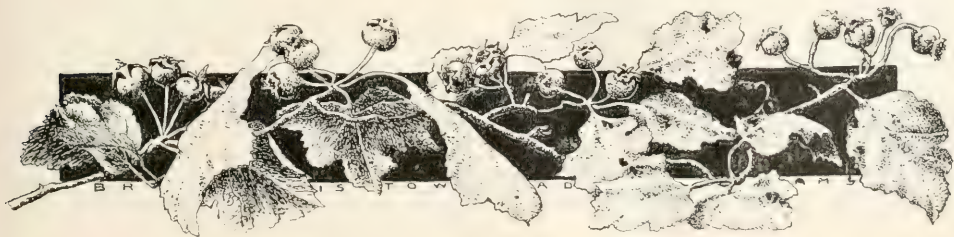
WAPTI IN DEEP SNOW.

Coyotes are plentiful, but the elk evidently have no dread of them. One day I crawled up to within fifty yards of a band of elk lying down. A coyote was walking about among them, and beyond an occasional look they paid no heed to him. He did not venture to go within fifteen or twenty paces of any one of them. In fact, except the cougar, I saw but one living thing attempt to molest the elk. This was a golden eagle. We saw several of these great birds. On one occasion we had ridden out to the foot of a great sloping mountain side, dotted over with bands and strings of elk amounting in the aggregate probably to a thousand head. Most of the bands were above the snow line—some appearing away back toward the ridge crests, and looking as small as mice. There was one band well below the snow line, and toward this we rode. While the elk were not shy or wary, in the sense that a hunter would use the words, they were by no means as familiar as the deer; and this particular band of elk, some twenty or thirty in all, watched us with interest as we approached. When we were still half a mile off they suddenly started to run toward us, evidently frightened by something. They ran quartering, and when about four hundred yards away we saw that an eagle was after them. Soon it swooped, and a yearling in the rear, weakly, and probably frightened by the swoop, turned a complete somersault, and when it recovered its feet, stood still. The great bird followed the rest of the band across a little ridge, beyond which they disappeared. Then it returned, soaring high in the heavens, and after two or three wide circles, swooped down at the solitary yearling, its legs hanging down. We halted at

two hundred yards to see the end. But the eagle could not quite make up its mind to attack. Twice it hovered within a foot or two of the yearling's head—again flew off and again returned. Finally the yearling trotted off after the rest of the band, and the eagle returned to the upper air. Later we found the carcass of a yearling, with two eagles, not to mention ravens and magpies, feeding on it; but I could not tell whether they had themselves killed the yearling or not.

Here and there in the region where the elk were abundant we came upon horses which for some reason had been left out through the winter. They were much wilder than the elk. Evidently the Yellowstone Park is a natural nursery and breeding ground of the elk, which here, as said above, far outnumber all the other game put together. In the winter, if they can not get to open water, they eat snow; but in several places where there had been springs which kept open all winter, we could see by the tracks they had been regularly used by bands of elk. The men working at the new road along the face of the cliffs beside the Yellowstone River near Tower Falls informed me that in October enormous droves of elk coming from the interior of the park and traveling northward to the lower lands had crossed the Yellowstone just above Tower Falls. Judging from their description, the elk had crossed by thousands in an uninterrupted stream, the passage taking many hours. In fact nowadays these Yellowstone elk are, with the exception of the Arctic caribou, the only American game which at times travel in immense droves like the buffalo of the old days.

To be concluded in July number.



TWO YEARS OF RECLAMATION WORK.

SECOND ANNIVERSARY OF PASSING OF THE RECLAMATION LAW IN JUNE—WORK HAS PROGRESSED RAPIDLY—A HIGHLY EFFICIENT ENGINEERING BODY HAS BEEN ORGANIZED—SUMMARY OF PROJECTS AND APPORTIONMENT OF FUND.

THE 17th of June is a day celebrated in American history, and it has an added meaning to people of the West, for upon that date, in the year 1902, President Roosevelt signed the Reclamation Act, initiating the great government work of reclaiming the arid lands of the West.

June 17, 1904, is the second anniversary of the Reclamation Service. Starting with a small group of engineers who had been engaged for years in studying the opportunities of reclamation, it has rapidly expanded within this short time to a large, well-balanced engineering corps that is the equal of any in the world. This has been done by drawing experienced men from all parts of the country, and particularly by grouping together those who have had practical experience in the construction of irrigation systems. The expansion of the work, though rapid, has been carried on with great caution. Every man has been considered and has been selected after competitive examination and full approval as to mental and physical qualifications.

At the outset fears were expressed that the reclamation law would prove disastrous to all concerned. The principal opponents of the passage of the law were among the wisest of the statesmen of both parties. They prophesied that there would be a sudden influx of political appointees and a carnival of spoilsmen in the distribution of the money. So far these gloomy forebodings have not proved in the least true. Great caution has been displayed in the organization and conduct of the work, and while energy and zeal have been employed, yet each step has been carefully considered by far-seeing engineers and business men.

The Secretary of the Interior has guarded every point from attack from the outside. He has said in effect to

his trusted agents, "Perform this work carefully and as rapidly as is consistent with business caution, and I will see that you are protected from outside pressure for places or spoils." He has committed to Mr. Charles D. Walcott, the Director of the Geological Survey, the larger aspect of the work, and has approved all of the important recommendations made by him.

Mr. Walcott, in the thorough and active way in which he has directed the Survey, has thrown himself into the prosecution of this great work. For years he has studied the question, and the passing of the Reclamation Law was but the signal he had been waiting for to set in motion the machinery of what has already proved to be a most competent organization.

The actual field-work of the Reclamation Service he has wisely left entirely to Mr. F. H. Newell, chief engineer, whose long service as head of the Division of Hydrography has given him unusual opportunities for studying the needs of the arid regions of the West. Under Mr. Newell's energetic lead the field-work has gone forward vigorously, with the result that today, two years from the passage of the Reclamation Law, fourteen highly important projects have been approved and funds apportioned for their construction. At this time a summary of the various reclamation projects being undertaken by the federal government will be of interest.

An apportionment of \$27,000,000 of the reclamation fund for the construction of fourteen irrigation projects in the arid West has been decided upon by the Secretary of the Interior, who has approved the plans of the engineers for works in the following states: Arizona, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming.

Actual construction has already begun on the Salt River project in Arizona and on the Truckee project in Nevada. Each of these projects involves a constructive cost of \$3,000,000.

UNCOMPAHGRE PROJECT, COLORADO.

The sum of \$2,500,000 is reserved for the completion of the Uncompahgre project. This project is located in Montrose and Delta counties, in western Colorado, on the west side of the main range of the Rocky Mountains. The source of water supply is the Gunnison River, from which it is expected that water will be taken by means of a tunnel about 6 miles in length, beginning in the Grand Canyon of the Gunnison and serving water in Uncompahgre Valley, a few miles northeast of the town of Montrose.

The Uncompahgre River flows through a broad, fertile valley, but its flow is quite inadequate for the irrigable lands. The Gunnison River, flowing through one of the most remarkable canyons in this country, carries a comparatively large volume of water, but little of which can be utilized in its drainage basin. It is proposed to divert a portion of this stream's flow in a tunnel cut through the mountains upon about 100,000 acres of land, a considerable portion of which is in private ownership in small tracts. When complete this will be one of the most remarkable engineering feats in the world.

MINIDOKA PROJECT, IDAHO.

In Idaho the sum of \$2,600,000 has been provisionally allotted for the construction of the Minidoka project in the valley of the Snake River. The area to be irrigated is about 120,000 acres. Practically all of the land under this project belongs to the government. It is proposed to divide the lands into tracts of 40 and 80 acres each, thus creating 1,400 new farms, with homes for 7,000 people.

This project contemplates the construction of a dam 50 feet high and 572 feet long, which will convert a canyon on the Snake River into a reservoir 35 miles long. Gravity canals run on each side of the river will cover 68,000 acres.

In addition to this, 17,000-horse power will be developed at the dam, which will be used for pumping a supply of water to irrigate about 53,000 acres of land lying above the gravity canals. Fifteen huge pumps, each having a capacity of about 110 second feet, or 50,000 gallons, a minute, will be installed.

YUMA PROJECT, CALIFORNIA.

For California the Secretary has set aside \$3,000,000 for the construction of an irrigation work on the Colorado River above Yuma. The irrigable lands in the Colorado basin consist almost entirely of long, narrow valleys, ranging from 5 to 10 feet in elevation above the stream in low water. A high percentage of these lands is inundated by the annual rise of the river, which occurs about July 1. The stream bed is of a shifting nature.

The general program for irrigation development along this stream is to be the irrigation of the valley lands in the immediate vicinity of the river in the territory of the United States. There are two reasons for this plan: First, the length of the canal line to reach these lands will be at a minimum, and, second, probably one-half the water applied for irrigation on these lands will return by seepage to the river, to be available for use above.

Extensive examinations for bed rock have been made along the stream, but no satisfactory bed rock has been found at any point. Any storage on the Colorado, as far as now known, will have to be accomplished in the upper reaches of the stream, and explorations are now being carried on in Colorado and Utah with this in view.

The September water supply is sufficient to irrigate 520,000 acres of land. There are 300,000 acres of land in the bottoms above the Yuma project and 400,000 acres including the Yuma project. Assuming that 50 per cent of this water returns from the 300,000 acres irrigated, there would be sufficient water for the irrigation of about 670,000 acres of land. The bottom lands in the valley of the Colorado River in the United States aggregate about 400,000 acres.

Levee surveys are being made to study the overflow problems near Yuma; canals are being located in the field and estimates prepared; diamond borings are being made at Bill Williams dam site; measurements of river flow; evaporation and seepage losses are being carried on in the canals.

MILK RIVER PROJECT, MONTANA.

For the completion of the Milk River project in Montana \$1,500,000 has been apportioned. This project in its entirety contemplates the storage in St. Mary Lakes of the flood waters of St. Marys River, a tributary of the Saskatchewan River in Hudson Bay drainage.

The flood waters are to be diverted either through a canal to Milk River, and allowed to flow down that stream through Canada and again be diverted in Montana above the point where it empties into the Missouri River, or by means of a canal connecting with Cut Bank Creek, a tributary of the Marias River, using the latter stream as a natural channel for 50 miles, and again diverting the water through canals upon the valley of the Lower Milk River.

Owing to the international complications which it is feared would arise, the Canadians already being users of the waters of the Milk River, it is probable that the plan of keeping the waters wholly within the United States will be adopted.

Milk River rises in the undulating foothills of the Rocky Mountains near the boundary line of Montana and Canada. Its headwaters flow northeasterly into Canada, and the stream continues for about 100 miles entirely parallel with the international boundary, and then turns southeasterly, passing through the northern part of Montana and emptying into the Missouri River. The valley through which the stream passes is broad and contains many thousands of acres of excellent arid land. The summer flow is not sufficient for the irrigation of any considerable part of this area, and the reinforcement of the supply by utilizing the stored waters of St. Mary Lakes will add greatly to the productive area of this section of the

state. It is probable that the first operations of the engineers will be confined to canal construction in the lower valley to utilize the unappropriated flow of the Milk River. About 250,000 acres are involved in the whole project and 68,500 in the first section.

NEBRASKA IRRIGATION PROJECT.

When it was determined that the Sweetwater reservoir probably could not be filled, owing to an inadequate water supply, search was made for other reservoir sites, and one was found on the North Platte River, about 3 miles below the mouth of Sweetwater River. This is at the beginning of the canyon through the Rattlesnake range of mountains. A dam constructed here will be 75 feet in length at the bottom, 200 feet high, and about 250 feet long at the top. Surveys show the superficial area of the reservoir thus created to be about 23,000 acres and the capacity 1,080,000 acre-feet. It is probable that it will hold all the flood and surplus water flowing in the North Platte River to this point. The waters thus stored will be used on lands in eastern Wyoming, in the Goshen Hole region of the North Platte River, and in western Nebraska.

HONDO PROJECT, NEW MEXICO.

The Hondo project in New Mexico is located on Hondo River, a tributary of Pecos River in southeastern New Mexico, about 12 miles southwest from the town of Roswell, in the county of Chaves. The river is torrential in character, and the ordinary summer supply is already appropriated.

It is proposed to construct a reservoir in a depression near the river, divert the storm or flood waters and unappropriated waterflow into the reservoir, and hold it for use during the irrigation season to irrigate lands lying east of the reservoir and south and southwest from Roswell. These lands are adjacent to productive fields near Roswell, and with an assured water supply could be put into cultivation at once. The area to be irrigated under this project embraces about 20,000 acres, and the cost will probably be about \$300,000.

FT. BUFORD PROJECT, NORTH DAKOTA.

This project is located on the west or left bank of Yellowstone River, the canal heading near Glendive, Montana. This project involves a canal about 80 miles long and covers 60,000 acres of land in Montana and North Dakota. The cost of the headworks is placed at \$72,000, and that of other constructions and excavations \$1,375,000, or a total of \$1,650,000, an average cost per acre of \$25.

MALHEUR PROJECT, OREGON.

This project contemplates the reclamation of land in eastern Oregon near Snake River, in the vicinity of the towns of Vale and Ontario. The irrigable tracts include about 40,000 acres of good bench land lying on the north and south sides of Malheur River. Two reservoir sites of sufficient capacity to retain all the flood waters have been found on the stream and have been surveyed.

BELLE FOURCHE PROJECT, SOUTH DAKOTA.

This project involves the reclamation of lands in the northeastern part of the Black Hills, in Butte and Meade counties, South Dakota, by the diversion of the waters of Belle Fourche River and the storage of its flood water in basins east of the town of Belle Fourche. These basins are to be converted into storage reservoirs by the construction of embankments of earth closing their outlets. From the reservoirs, which are filled by a large feeder canal from the river, the water will be distributed to lands in the Belle Fourche Valley, where it is thought at least 90,000 acres may be reclaimed, about one-half of which is in public ownership. Power has also been developed at the Dry Creek reservoir and employed to elevate water to Upper Indian Creek flat, where some 15,000 acres of land are located, nearly all in public ownership.

The reclamation works, it is estimated, will cost about \$1,230,000.

UTAH LAKE PROJECT, UTAH.

Utah Lake is in effect a large storage reservoir, catching the mountain flow and delivering it into the canals. Un-

fortunately, however, the lake is too large for effective use, and the losses by evaporation are far in excess of the amount put to beneficial use. An extension of irrigation in Salt River Valley is dependent upon the ability to reduce the loss by evaporation, and to handle Utah Lake more effectively.

The lands which will probably be included in this project are probably all in private ownership, and comprise an area of about 70,000 acres. The entire bed of Utah Lake, covering 140,000 square miles, has been contoured at intervals of one foot, and all the principal streams flowing into the lake have been systematically measured at the flood season and at low water.

One million dollars have been set aside for this project.

BIG BEND PROJECT, WASHINGTON.

This project contemplates the reclamation of a large body of land surrounded partly by the Columbia River, which flows along the northerly and westerly sides. The lands in 154 townships have been withdrawn from entry pending an investigation of this project.

A number of reservoirs in connection with this project has been discovered and all public lands within their area withdrawn from entry for reservoir purposes. Considered as a whole, the Big Bend project embraces the largest area of irrigable land of any project under consideration by the government. The Secretary has set aside \$1,150,000 for the continuance of the work on this project.

CODY PROJECT, WYOMING.

This project contemplates the reclamation of land on the north side of Shoshone River, in the town of Cody, in Bighorn county. The irrigable land extends along the river for a distance of about 40 miles and comprises approximately 93,000 acres, most of it being high-grade agricultural land. In addition to this land, about 9,000 acres on the south side of the river may be reclaimed and several thousand acres more in the drainage area of Clark Fork. All of the land lies at an elevation of from 4,150 to 5,150 feet above

sea level. Shoshone River discharges a relatively large amount of water, and its summer flow has not been entirely appropriated. Six miles above the town of Cody the river enters a canyon cut through solid granite for a distance of one and a half miles. At the upper end of this canyon it is proposed to construct a dam of uncoursed masonry.

The dimensions of the dam will be—height, 170 feet; length on bottom, 65 feet, and length on top, 150 feet. This dam will form a reservoir in the basin above the canyon with a capacity of 159,500 acre-feet. The stored water will be used to reinforce the summer flow. The estimated cost of this project is \$2,250,000.

PLANTING WHITE PINE.

INVESTIGATIONS BY THE BUREAU OF FORESTRY PROVE IT TO BE COMMERCIALY FEASIBLE IN NEW ENGLAND.*

IT has often been held that plantations of white pine can not be made profitable. Contentions have constantly arisen to the effect that the first cost, taxes, and interest on the investment are enough to eat up all the returns that may be expected from white pine plantations, and that forty years, the time when the first cutting may be profitably made, is too long to wait for the profits involved; should there be any. It is right that all of these things should be taken into consideration, and it would be palpably unwise to undertake a pine plantation on land which could be used to better advantage for general agricultural purposes. In fact, white pine planting in the New England and adjacent states is of most value where a number of uses may be served, as the timber result alone may not be sufficiently profitable to make it wise. In the case of waste lands, however, white pine might just as well be raised as scrub growths, which have no chance of adding value.

Where planting is apt to prove most valuable is on watershed areas in connection with reservoirs, on sand barrens and dunes, on bare soils and worn-out pastures, on cut-over land, and for woodlots. Many of the "abandoned farms" of New England had best be abandoned to a good growth of white pine, even at considerable initial expense.

Boston and other New England cities depend on lakes and reservoirs for their

water supply. The better forested the tributary watershed is, the better it is for the water, from the points of view of both quantity and quality, and at Clinton, Mass., 1,500 acres are being planted in white pine and sugar maple, in mixture, for the single purpose of regulating and purifying the water supplied to Boston and other towns, though the question of ultimate lumbering operations is also being taken into consideration. Often the planting will prevent drifting sand from encroaching on valuable property. Again, on bare soils and worn-out pastures, where there is a very slow and unsatisfactory growth of white pine by natural reproduction—the resulting growth being low, branchy, and undesirable—the expense of planting is minimized, and the probable results more satisfactory. Cut-over lands and woodlots may be planted to pine with every expectation of good results, and in the latter the actual results in fuel and timber are not the only ones to be considered. Where they may be utilized as wind-breaks for buildings or orchards they serve a double purpose. Always it is well to keep in mind the dual or triple usefulness of the plantations, and count the profits in more than the single item of sales of timber.

There is ample opportunity to study the question of profits in New England, because during the period between 1820 and 1880 the enthusiasm for white pine planting amounted almost to a fad. Men

* Bulletin No. 45, Bureau of Forestry, Washington, D. C. The Planting of White Pine in New England, by Harold B. Kempton.



PLANTED WHITE PINE 43 YEARS OLD.

foresaw the time when marketable native pine would be gone, and when planted timber would be of economic importance. Then about 1880 the cheap transportation rates from new white pine fields began to put a damper on further planting. But with present conditions there is still reason for a continuation of the planting. Careful surveys have been made of a number of these older planta-

tions in almost all of the New England states and in Pennsylvania and Virginia. Practically all of them have been planted long enough for a definite basis of profit calculation to be established in accordance with the methods used for making the plantation—the first cost, the use of other trees in mixture, and the treatment after planting.

In all cases it must be understood



INTERIOR OF PLANTATION IN EXPOSED SITUATION ON NARRAGANSETT BAY.

that white pine is reproduced from seed, which may be gathered or bought at a comparatively low cost of effort or of money. The percentage of germination is high, and with care a pound of seed, at an average cost of \$2.50, will produce about 12,000 seedlings, which will be

suitable for transplanting. Only under favorable conditions will it pay to sow broadcast for in-place planting, with thinning afterwards, and local conditions as to the supply of seeds or seedlings should be consulted in every instance. Various methods of collecting the seed

have been resorted to, though the expensive one of cutting down a seed tree is now seldom practiced, save when the tree is ripe for lumber. It is necessary to collect the seed from the tree in order to prevent loss, because the cone opens and throws its seeds before falling from the tree. Seed years occur at irregular intervals of from four to seven years, and, as the seed takes two years to mature, it is possible to predict a seed year twelve months in advance of the crop, and thus have all preparations made for the planting when seed is abundant and fresh. The seed bed should be well prepared, and should preferably be a sandy loam, well drained. The seeds are planted in rows, and the seedling must be protected from too much moisture and too much sun. For these purposes lath or canvas screens are used as shade frames, or, if tilted, will keep out excess of rain. Keeping the tender shoots free from choking weeds is absolutely necessary. From all these preparations it can be seen that there is considerable expense connected with the starting of the plantation. Then there comes transplanting in early spring or late fall, and care after that operation.

A six-foot interval is usual for the transplanted trees. After this, pruning is an important item and must be done carefully, removing the branches to as high as a man can reach, when the trees are about fifteen years old. Later still, thinning will have to be done in many plantations, so that the final stand will be about twelve by twelve feet apart.

Of the mixtures used and their com-

parative values, it may be said of the common ones that European larch is not particularly advantageous, and that the mixture benefits the larch, but has no good effects for the pine. Oaks are of indifferent value, and white oak, though a valuable tree, is not adapted, owing to its slow growth. Chestnut is excellent, as, when it begins to overtop the pine, it may be profitably cut for posts, poles, or ties after having furnished the necessary shade. Scotch pine has no disadvantages as far as the growth of each species is concerned, but it is of inferior commercial value, and therefore of less account than other species would be. Red pine is subject to the same objections as the larch, and, where a good growth of white pine is the ultimate object, it has many disadvantages. Norway spruce is of value to both trees in mixture, and when the time comes for thinning the spruce is of marketable size. In many ways sugar maple is the best economic mixture of all, for the seedlings may be obtained at less than half the cost of the pine, and there can be planted just enough of the pine for the future stand when the maple is removed.

The age for the profitable lumbering of the pine is about forty years. It is then valuable for boxes at about \$4 a cord on the stump, or about \$160 per acre. A bulletin prepared by the Bureau of Forestry, which gives a detailed account of several plantations, places the net annual return from planted white pine in New England at \$1.15 per acre, paid at the end of forty years, in addition to compound interest at 4 per cent on the money invested.



FOREST THINNING AND ITS RESULTS.

BY

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PART I.

THERE are few forest problems in which a general knowledge of the practice of thinning is not of assistance, and as soon as an intensive forest system becomes practical it is of the greatest importance. The necessity of lessening the fierce struggle in the forest for the survival of the fittest is evident to all who have had any experience in woodcraft, and even in this country a few wood-lot owners have developed ideas on the subject generally without ever hearing of the art of forestry. The value of thinning being apparent in a general way, we find that its origin dates as far back as the history of forestry itself, and that it was one of the first branches of the art to become systematized. As early as the sixteenth century thinnings were planned by a regular method in certain parts of Germany, and from that time they became more and more general in Europe. When forestry became an art, in the latter half of the eighteenth century, the theory and practice of thinning received a large share of attention, and from the beginning of the nineteenth century to the present day there have been definite experiments to determine the increased increment and quality of timber resulting from different methods. Although experiments have covered so wide a period, it is strange that little definite information has appeared until quite recently, and as yet only in the European forest periodicals and experiment station reports. Even the German text-books are lacking in exact data and reports on the subject, while in English there is nothing known to the writer beyond a few general principles. The object of the following two papers is to give the latest results of experiments showing the proper degree of

thinning necessary to produce the most lucrative intermediate yield and the best results from the final yield in the shortest time.*

Part I deals with the theory and practice of thinning; Part II will give the results obtained from definite experiments, together with a few notes concerning the adaptation of these to American conditions.

PART I.—THE THEORY AND PRACTICE OF THINNINGS IN EUROPE.

A.—*The Value of Thinning.*

A normal stand of coniferous timber on first-quality soil begins with about 4,000 trees to the acre, but at maturity (100–120 years) there are seldom more than 300 trees, of which only 200 to 150 belong to the final merchantable yield of saw timber. It seems an enormous waste of time and energy to plant such a number and yet have only one-tenth or less of them pay the bulk of the expense and the final profit. Yet there is no other method possible. The object of a forest system is to obtain the greatest amount of timber in merchantable form per given area in the shortest time. If fewer trees are planted to the acre the resulting mature specimens have not the cleanness of shaft and fullness of form necessary for good lumber. If this fact needs proving, a British example may be cited. By the crude methods of forestry in Great Britain the woods are planted wide and heavily thinned, so

* The authorities used are: Manuscript notes from the lectures of Professors Buehler and Lorey at Tuebingen; Ph. Flury in vol. vii, *Mitteilungen der Schw. Centralanstalt fuer das Forstl. Versuchswesen*; M. Kunze in *Tharandter Forstl. Jahrbuch*, vol. 45; Professor Lorey in the *Forst und Jagdt Zeitung*, and C. Laschke, *History of Thinnings*.

that the cover is permanently broken. As a result, builders always specify foreign-grown timber in their plans for all but poorest grades, the home-grown stock selling far below the imported.*

Aside from quality, there is also a much greater volume yield per acre by close planting. In a natural forest the yield over a large area seldom exceeds 25,000 feet, yet in Germany for the whole coniferous forest the average stand of merchantable Scotch pine is 42,000 B. F. per acre and for spruce and fir about 77,000 feet.

To understand the conditions which produce such yields from the small per cent of planted trees, the life history of the individuals in the stand must be analyzed. Such a forest usually closes about the sixth year, and from that time on each tree enters into fierce combat with its neighbors for light and room. The struggle soon has its effect on the individuals of the stand, which may then be divided into three broad classes: Dominant, overtopped, and suppressed. Narrower classification separates the dominant class into three, making the division as follows:

I. Decidedly dominant. Trees with exceptionally well-developed crowns.

II. Dominant. Trees with well-developed crowns.

III. Codominant. Trees with fairly normal crowns, but with relatively poor development.

IV. Overtopped.

a. With badly formed crown, but free in one or more directions.

b. Very poor crown, but still free in one direction.

V. Suppressed.

a. Crown still thrifty, but absolutely overtopped.

b. Dying or dead.

As the number per acre falls so suddenly with the development to maturity, it stands to reason that the greatest number of trees and the main increment must be found in the dominant stand. Experiment has proved that the per cent of total increment in the five classes compared with their relative number per given area is as follows:

Spruce 18 to 30 Years Old.

Per cent of total number.		Per cent of total increment.	
I.....	66	I.....	40
II.....		II.....	24
III.....	9	III.....	17
IV.....	7	IV.....	12
V.....	18	V.....	7

As the total number of trees at this age is about 1,650, it is evident that the future merchantable yield will be made up of only a small part of classes I and II, and that the increment of the other trees will be lost in the depletion of the stand as it matures.

The main object of the thinning then is two-fold:

1. To use the growth of the intermediate stand, which is not inconsiderable.

2. To shift as much as possible of the total increment on the trees of the final stand by the removal of trees which crowd it, but which can not mature as merchantable trees of desired quality. The following table, the figures of which are taken from various experimental areas, adds clearness to the subject:

Spruce, First Quality.

Age.	Number per acre.	Height in feet.	Volume, cubic feet per acre.
92.....	210	101	15,554
93.....	254	100	15,274
92.....	343	107	18,527
95.....	365	101	16,786
100.....	208	121	19,670
100.....	228	108	15,814
101.....	315	99	16,590

From this it is clear that at maturity 200 trees or so can produce the same volume of merchantable timber as 250 or even 300 trees, and that the difference can be used in the interim without decreasing the final crop; nor does this take into consideration the improved quality and greater value of timber in the final stand. In the preceding table it will be noticed that the best acres for volume show the best development in

* Parliamentary Report on British Forestry, 1903.

height. Any curve of height growth shows a decided falling off after the fortieth year or so, and a method that will stimulate growth during this period is likely to add directly to the yield. This seems to be the case in these instances and adds evidence to the value of thinnings.

To recapitulate, the importance of thinnings lie in the improved quality and quantity of the final yield obtained by the use of timber, which would otherwise go to waste, thus giving an intermediate yield which greatly helps the financial success of the long crop rotation often necessary in forestry. This intermediate yield is an appreciable item in every German forest estate. The average annual intermediate yield of merchantable poles and logs for Württemberg amounts to 252 cubic feet, for the first-quality class of conifers it is 378 cubic feet, and in special cases it often comes to 840 cubic feet. Other good results of thinning are as follows:

1. The mixture can be regulated and undesirable species removed.
2. The quality of the mixture bettered—decayed, diseased, and badly formed trees removed.
3. The danger of breakage from snow, ice, and storm lessened. By allowing each crown and bole a better development, the cover is made stronger and more resistant to storms.
4. The danger from insects and fire is lessened by the removal of dead and dying timber.

B.—*The Technique of Thinning.*

All systems of thinning are based on a division of the stand into classes similar to those given above. Until quite recently only three degrees were in common use, being designated by the letters A, B, and C, or "light," "medium," and "heavy," the C, or heavy, not breaking the forest cover by more than 2.5 per cent. These grades cut into the stand as follows:

Thinning.	Classes removed.
A.....	V, b and a.
B.....	V, b and a, and IV, b.
C.....	V, b and a, and IV, b and a.

Of late less conservative ideas have come into vogue, and in all recent experiments the division is made into four main grades: A, light; B, medium; C, heavy, and D, very heavy. The classes taken under this system and the per cent of the total stand removed are as follows:

Thinning.	Classes taken out.	Per cent of total number.
A.....	V.....	5-20
B.....	V, IV.....	20-30
C.....	V, IV, III.....	30-40
D.....	V, IV, III.....	40-80
	And part of II.....	

A stand of maturing trees falls into two main classes in reference to the future merchantable crop: The *final stand*, out of which the mature trees will be recruited, and the *intermediate stand*, which has fallen behind and will evidently perish before the period of rotation is over. These two divisions vary in composition with the age of the forest. In relation to each other, however, they are constant, the final stand being composed of classes I, II, and III, and the intermediate stand of IV and V. The less radical methods of thinning only attack the intermediate stand, but C and D enter boldly into the recruiting ground of the final crop. Common experience in practice, without experiment, has shown that slight thinning neither gives a very paying intermediate yield, nor greatly improves the growth and quality on the final stand. The value of this method seems clear from the figures given above, which show that the greatest increment and the greatest number of trees are in classes I and II; hence it follows that competition is most severe in this class, and that the greatest volume can be most profitably removed therefrom.

Beside grades C and D many systems of regular thinning in the final stand have been advocated, the most practical and generally used of which is the French method, *éclaircie par le haut*. By this the best trees of the final stand (approximately equal to the number of

the mature crop) are set free on all sides by the removal of all their immediate neighbors which crowd them, irrespective of the class to which they belong. The rest of the stand is thinned by grade A and made to serve as ground cover and keep the selected trees well pruned and full-boled. This may be called "selection thinning," and is designated as D A. It has given good results in practice, the intermediate yield being excellent and the final yield of the best quality and quantity.

The time for the first thinning and the subsequent recurrence depends, like everything else in forestry, on the situ-

ation of the forest and the market conditions. Theoretically, they should begin after the cover is established, say in the tenth or twelfth year, and continue in five or ten year intervals throughout the period of greatest growth.

In conclusion, let it be said that a thinning never permanently breaks the forest cover. In the heaviest D thinning the forest should not take longer than three to five years in recovering itself. Of course, the degree of thinning depends entirely on species, age, and soil quality, but any permanent break in cover is a light increment cutting and belongs to a different question.

RECLAMATION WORK IN NEW MEXICO.

DESCRIPTION OF ONE OF THE FIRST PROJECTS LIKELY TO BE TAKEN UP IN THIS TERRITORY.

THE report of Mr. W. M. Reed, Resident Engineer of the Service, is of particular interest by reason of the fact that it is probable the government will begin at an early date the construction of an irrigation work at one of the sites recommended by him. Apparently the most feasible project discovered by Mr. Reed is on the Hondo at a point nearly on the dividing line of the watersheds of Hondo River and the Black Water Arroyo. The reservoir site lies in a large natural depression commonly called a dry lake, and has an area of 1,072 acres, and with no embankment would hold 11,480 acre feet. The bottom of the lake is a heavy alluvial deposit, and borings were satisfactory as to its water-holding properties. The perimeter is nearly all limestone, and has the appearance of being as solid and free from cavities as any limestone formation, except at the places where fills are required. The sides are much higher than the proposed water line and have rock on or near the surface.

Mr. Reed's plan for diverting the water is to make two canals of sufficient size to carry all the flow of the river, and to provide a spillway on the canal at a rock point 4,000 feet from the river. The river at the point of diver-

sion is in earth, and to provide for a spillway here would be expensive and would be always a source of annoyance if not danger. Two spillways or flushing gates are placed on the canal, each in solid rock, with their grade two feet below the grade of the canal at that point. These spillways are provided with gates, not automatic, for these gates are to be used only when the reservoir is full, or when it is desired to flush the silting basins. The top of the gates will be below the embankment grade, and will act as safety spillways in the case of unexpected and unusual floods.

The canal will have a seventy-foot road bed, and an embankment will be placed at the lower side. The canal will enter the reservoir from a rock cut, thus preventing any erosion. The outlet canal will connect the lowest point in the reservoir site with the original bed of the river. The elevation at these points being the same, the canal is level.

The bed of the Hondo will be used for carrying the irrigating water for a distance of about one mile. At this point it will be turned by a small concrete diversion dam into distributing canals on one side of the river. This point of diversion is not the most suitable from

an engineering standpoint, but up to the present time one of the owners of the flood-water rights, having a ditch just below it, has refused to make any satisfactory proposition toward a settlement with the government in case the reservoir should be constructed, and it was deemed best to locate the canal from the above point to determine what lands would come under irrigation, and to ascertain the cost of the works. Diversion from a point lower down the river would lessen the cost and would bring the same lands under cultivation.

basins at the downstream side a spillway will be placed in the bank of the canal with a bottom grade below that of the canal. At times of heavy rainfall, when water rushes down the arroyos, the spill or flush gates will be opened and the silt removed from the basins. The water passing through these flush gates will spread out over the bottom land and ultimately reach the old bed of the river, and can be sluiced down the river in the same manner that nature has been doing for ages. Except during the flood time the Hondo water carries very little silt,



AN IRRIGATION DAM IN NEW MEXICO.

During floods the Hondo carries a large amount of silt. Engineer Reed proposes the following plan to prevent danger of the reservoir filling from this source: The velocity of the canal is to be governed to such an extent that the heavier silt will be deposited in basins, which are provided by making the alignment of the canal to cross three arroyos near their mouth, where the surface flattens out. Two of these arroyos have a length of five or six miles and drain considerable territory. At the end of the

and therefore during the non-irrigating season, when there is a constant flow in the river, it is advisable to pass the water through the canal and into the reservoir with as little exposure to seepage and evaporation as possible. To be able to do this at one time, and also at other times pass a little body of water through as a slow current, it is proposed to place a removable bulk-heading or gates below the sluiceways, and thus be able to delay or check the current, causing the silt to settle in the basins.

FOREST LEGISLATION IN NEW YORK.

IMPORTANT AMENDMENTS TO THE FIRE LAW—BOUNDARIES OF THE ADIRONDACK AND CATSKILL PARKS DEFINED—PRO- POSED AMENDMENT OF CONSTITUTION.

FOREST matters received considerable attention at the latest session of the New York legislature, recently closed. First in importance to the forest interests of the state were the amendments made to the forest fire law, brought about mainly through the terrible conflagrations of the spring of 1903. It would now seem that the protection of the state forests is up to those persons whose business it is to look after them, for the weak points of the fire law have been pretty thoroughly overhauled.

Bills were also passed amending the forest, fish, and game law in regard to defining the boundaries of the Adirondack Park, and to create a Catskill Park and define its boundaries. The general supply bill carried a provision for \$250,000 to be used for the purchase of lands for the Adirondack and the Catskill Parks.

The senate and assembly also passed a concurrent resolution which provides for amendment of section seven of article seven of the constitution in so far as necessary to secure the removal of dead timber on burned areas of state lands.

These several measures are of such particular interest to the readers of **FORESTRY AND IRRIGATION** that the text of each is given here in full.

I.

AN ACT TO AMEND THE FOREST, FISH, AND GAME LAW IN RELATION TO THE PREVENTION OF FOREST FIRES.

SECTION 1. Section two hundred and twenty-four *a* of chapter twenty of the laws of nineteen hundred, entitled "An act for the protection of the forests, fish and game of the state, constituting chapter thirty-one of the general laws," is hereby amended to read as follows:

SEC. 224*a*. Chief fire warden and foresters.—The commission shall appoint a chief fire warden who shall re-

ceive an annual salary of fifteen hundred dollars and his necessary, traveling expenses, and who shall have supervision of town fire wardens, visit and instruct them in their duties and enforce the law as to fire districts in towns and under the authority of the commission commence prosecutions for violations of laws to prevent forest fires; and may from time to time employ expert foresters (at a total annual compensation not to exceed three thousand dollars) and at a rate not exceeding fifteen hundred dollars a year for any forester. The chief and expert foresters shall hold office during the pleasure of the commission and perform such duties for the preservation of forests as the commission shall prescribe. The commissioner may also appoint five assistant fire wardens, at least four of whom shall during seasons of the year when forest fires occur, serve along lines of steam railroads in the forest preserve counties of the Adirondacks. They shall inspect such railroads and the engines thereon, reporting to the commissioner the condition thereof for purposes of fire prevention, and perform such other duties in preventing forest fires as the chief fire warden or the commissioner shall direct. They shall also have the powers and duties of game protectors, and when not needed as fire wardens may be employed as game protectors or in reforestation, or as the commissioner may direct. They shall each receive an annual salary of six hundred dollars and an allowance for expenses not exceeding four hundred and fifty dollars.

SEC. 2. Said act is hereby amended by adding a section, to be known as two hundred and twenty-four *b*.

SEC. 224*b*. Fire patrol.—Whenever in the judgment of the commissioner it is necessary to protect the forests from fire, he shall organize and as long as necessary maintain a fire patrol along

the lines of railroads in forests in counties containing parts of the forest preserve, and at such other places in such counties as the public interest requires. Such patrol shall be organized and maintained under the chief and assistant fire wardens who shall themselves be placed in charge of sections of the exposed areas as fire patrols. Game protectors may, so far as the public interest will permit, be detailed as additional assistant fire wardens for such patrol under the chief fire warden. The commissioner may also in case of immediate peril from fire, with the consent of the governor, employ temporarily such additional assistants to maintain an efficient fire patrol as the public interest requires. The chief fire warden and assistant fire wardens when engaged in inspection of railroad lines and engines or on fire-patrol duty on railroad lines, as herein provided, shall be transported without charge from point to point as their duties shall require, by the railroad companies on whose lines such fire patrol and inspection are maintained. The commissioner shall keep account of the cost of maintaining any such fire patrol and system of inspection along the line of a railroad in the forest preserve, including therein the salaries, expenses and wages of public officers or employes directly engaged in maintaining such patrol for the time that the said patrol and inspection are maintained, and one-half the cost thereof during the preceding year shall be paid by the railroad company on the first day of December of each year to the commissioner. The commissioner may also organize in any town in the forest preserve a fire patrol during the season when fires occur. One-half the expense thereof shall be a town charge, and one-half shall be paid by the state unless according to the last assessment-roll of such town more than one-half of the landed property therein in value, is the property of the state, in which case the state shall pay such a proportion of the cost of such patrol as the value of the lands held by the state bears to the entire assessed valuation of such town, and the remainder shall be a town charge. If the state pay the whole

amount the commissioner may collect the amount payable by any town of such town.

SEC. 3. Section two hundred and twenty-five of this act is hereby amended to read as follows:

SEC. 225. Fire wardens and fire districts.—The commission (shall) may from time to time in every town having lands which are part of the forest preserve, and may in every town having lands which would become part of the forest preserve if acquired by the state, appoint a fire warden who shall act during the pleasure of the commission. When required by the commission, such fire warden shall, and any such fire warden may establish two or more fire districts in his town. He may also by a written appointment filed in the town clerk's office, from time to time appoint a resident citizen in each district as district fire warden who shall act during the pleasure of the fire warden. (Such districts shall be established by filing in the town clerk's office a map showing the boundaries thereof and by posting a duplicate map in a public place in the town. The cost of such maps not exceeding ten dollars shall be a town charge.) In every other town the supervisor shall be fire warden by virtue of his office. If the supervisor be absent when fire occurs, or fail to act, any justice of the peace in the town may act as fire warden. If in a town situated in a county containing lands of the forest preserve, the commission is unable to find a suitable person who will accept the position of fire warden, then the supervisor of that town shall act as fire warden and discharge all the duties devolving on that office by law, and shall promptly make to the chief fire warden a report of each forest fire that occurs in his town.

SEC. 4. Section two hundred and twenty-six of said act is hereby amended to read as follows:

SEC. 226. Duties of fire wardens.—Under the commission a fire warden is charged with preventing and extinguishing forest fires in his town. During a season of drought a fire warden may, with the approval of the commissioner, establish a fire patrol in his town. In

case of fire in or threatening forest or woodland, the district fire warden, if any, or if none, the fire warden shall attend forthwith and use all necessary means to confine and extinguish the same. The fire warden may destroy fences or plow land, or in an emergency, set backfires to check fire. Either the fire warden or a district fire warden may, summon any resident of his town to assist in putting out fires. Any person summoned who is physically able and refuses to assist, shall be liable to a penalty of ten dollars. An action for trespass shall not be against persons crossing or working upon lands of another to extinguish fire. In case a forest fire burn over more than an acre of land, the fire warden of the town in which it occurs shall make a report thereof to the commission, giving the area burned over, the quantity of timber, wood, logs, bark or other forest products, and of fences, bridges, and buildings destroyed with an estimate of the value thereof. He shall also report the cause of such fire and the means used in putting it out.

SEC. 5. Section two hundred and twenty-eight of said act is hereby amended to read as follows :

SEC. 228. Railroads in forest lands.— Every railroad company shall on such part of its road as passes through forest lands or lands subject to fires from any cause, cut and remove from its right of way along such lands at least twice a year, all grass, brush and other inflammable materials. Where the railroad runs through forest lands in counties containing part of the forest preserve, it shall so cut and remove the same from its right of way whenever required by the commissioner ; employ in seasons of drought and before vegetation has revived in the spring, sufficient trackmen to promptly put out fires on its right of way ; provide locomotives thereon with (steel) netting of steel or iron wire (on the smokestacks) so constructed as to give the best practicable protection against the escape of fire and sparks from the smokestacks thereof (to prevent the escape of fire and sparks) and adequate devices to prevent the escape of fire from ash pans and furnaces which shall be used (by every

engineer and fireman) on such (part of its road) locomotives. The railroad commission must upon the request of the forest, fish and game commissioner, and on notice to the railroad company or companies affected, require any railroad company having a railroad running through forest lands in counties containing parts of the forest preserve, to adopt such devices and precautions against setting fire upon its line in such forest lands as the public interest requires. No railroad company or employé thereof shall deposit fire coals or ashes on its track or right of way near such lands. In case of fire on its own or neighboring lands, the railroad company shall use all practicable means to put it out. Engineers, conductors or trainmen discovering or knowing of fires in fences or other material along or near the right of way of the railroad in such lands, shall report the same at the first station to the station agent, and such station agent shall forthwith notify the nearest fire warden or game protector thereof, and use all necessary means to extinguish the same. (Any railroad company or employé thereof violating any provision of this section shall be liable to a penalty of one hundred dollars for every such violation.) Any railroad company failing or neglecting to comply with any of the provisions of this section, or any order of the railroad commission made pursuant to the provisions of this section, shall be liable to a penalty of one hundred dollars for each day that it continues a violation thereof, and any officer or employé of a railroad company violating any provision of this section or neglecting to comply with any requirement of the railroad commission duly ordered, shall be liable to a penalty of one hundred dollars for every such violation. The supreme court may on notice to the persons or corporations affected enforce compliance with any such order of the railroad commission.

SEC. 6. Section two hundred and thirty of said act is hereby amended to read as follows :

SEC. 230. Forest fires prohibited.— A person who willfully or negligently sets fire to waste or forest lands of the

state or of a private person, or who suffers a fire on his own lands to extend therefrom or to state lands is guilty of a misdemeanor and may be imprisoned not more than one year and be liable to pay a fine of not more than two hundred and fifty dollars or both. He shall also be liable to the state or any person for the damages caused by such wrongful act. If state lands in the forest preserve are or have been damaged willfully or negligently as aforesaid, an action to recover the damages shall be maintained in the name of the people of the state on the order of the commissioner by counsel designated by him, and recovery shall be had therefor. The fact that such fire may have extended to state lands by crossing one or more tracts of land intermediate the place of setting fire and the state lands shall not bar recovery by the state when the damage done is within five miles of the place where the fire was set. This act shall not be construed to limit the recovery in cases where there are no such intervening tracts of land.

SEC. 7. This act shall take effect immediately.

II.

AN ACT TO AMEND THE FOREST, FISH, AND GAME LAW, IN RELATION TO AND DEFINING THE BOUNDARIES OF THE ADIRONDACK PARK.

SECTION 1. Section two hundred and seventeen of chapter twenty of the laws of nineteen hundred, entitled "An act for the protection of the forests, fish and game of the state, constituting chapter thirty-one of the general laws," as amended by chapter six hundred and eight of the laws of nineteen hundred, is hereby amended so as to read as follows:

SEC. 217. Adirondack Park.—The Adirondack Park shall include all lands now owned or hereafter acquired by the state within the following bounds: Beginning at the southeast corner of the town of Hope in the county of Hamilton, and running thence westerly along the southerly lines of Hamilton county and continuing and following the southerly line of the town of Wilmurt, in Herkimer county, to the point of inter-

section with the westerly line of Herkimer, and thence northerly along the westerly lines of Herkimer county to its junction with the southwesterly line of Saint Lawrence county; thence westerly along said southwesterly line of Saint Lawrence county to the most westerly corner of township fourteen, great tract three, Macomb's purchase; thence easterly along the northerly line of said township fourteen to the northeast corner thereof; thence northerly along the west line of township thirteen, great tract three, Macomb's purchase, to the northwest corner of said township thirteen; thence east along the north line of said township thirteen and the south line of township ten, tract and purchase aforesaid, to the southwest corner of the southeast quarter of said township ten; thence north along the west line of the said southeast quarter of the aforesaid township ten to the north line of said township; thence east along said north line to the west line of township seven, great tract two, Macomb's purchase; thence northerly along the west line of township seven aforesaid to the northwest corner of the township; thence easterly along the northerly lines of townships seven and eight, great tract two, Macomb's purchase, to the southwest corner of township twelve of said great tract two; thence northerly along the west line of township twelve to the northwest corner of lot one in the south half of said township; thence easterly along the north line of said south half of said township twelve to the west line of the county of Franklin; thence north along the west line of the county of Franklin to the northwest corner of the south half of township thirteen of great tract one, Macomb's purchase; thence easterly along the northerly line of the south half of townships thirteen, fourteen, and fifteen of said great tract one, Macomb's purchase, to the west line of the old military tract; thence south along said west line to the northwest corner of township ten of said old military tract; thence easterly along the north line of said township ten to the west line of Clinton county; thence southerly along the west line of Clinton county to the north line of Essex

county ; thence easterly along the north line of Essex county to the northeast corner of the town of Wilmington ; thence along the east and easterly lines of the town of Wilmington to the intersection with the north line of the town of Keene ; thence east to the northeast corner of said town of Keene ; thence southerly along the easterly line of the town of Keene to the southeast corner thereof ; thence easterly along the northerly line of the town of North Hudson to the most northeasterly corner of the said town ; thence southerly along the easterly lines of the towns of North Hudson and Schroon to the southeast corner of the said town of Schroon ; thence westerly along the southerly lines of the towns of Schroon and Minerva to the northeasterly corner of Leggett's survey of the southwest quarter of township fourteen of Totten and Crossfield's purchase ; thence southeasterly along the line of Leggett's survey to the southerly line of said township fourteen ; thence southwesterly along the line of Leggett's survey, being the southerly line of said township fourteen, to the most southerly corner of said township ; thence southeasterly along the easterly line of township thirteen and the westerly line of township twelve to the southeasterly corner of lot twenty-five of township eleven of said Totten and Crossfield's purchase ; thence southwesterly along the southerly lines of lots twenty-five, twenty-six, twenty-seven and twenty-eight to the southwesterly corner of said lot twenty-eight ; thence southeasterly along the easterly lines of lots forty-four, fifty-three, sixty-eight, seventy-seven and five of said township eleven and of lots nine, twenty-one, thirty, thirty-seven and forty of the gore between township eleven of Totten and Crossfield's purchase and the Dartmouth patent and of lots five of ranges six, seven, eight, nine and ten of the Dartmouth patent to the southeasterly corner of lot five of said range six of said patent in Warren county ; thence westerly along the southerly line of said range six of said Dartmouth patent to the northeasterly line of Palmer's purchase ; thence south-

easterly along the easterly line of said Palmer's purchase to the most easterly corner of the middle division of said purchase ; thence southwesterly along the southerly line of the said middle division of Palmer's purchase through Saratoga county to the easterly boundary of the town of Hope in Hamilton county ; thence southerly along the east line of the town of Hope to the place of beginning. (County of Hamilton ; the towns of Newcomb, Minerva, Schroon, North Hudson, Keene, North Elba, Saint Armad and Wilmington, in the county of Essex ; the towns of Harrietstown, Santa Clara, Altamont, Waverly and Brighton, in the county of Franklin ; the towns of Webb and Wilmurt in the county of Herkimer ; the towns of Hopkinton, Colton, Clifton, and Fine, in the county of Saint Lawrence, and the towns of Johnsburg, Stony Creek and Thurman and the islands in Lake George in the county of Warren.) Such park shall forever be reserved and maintained for the free use of all the people.

SEC. 2. This act shall take effect immediately.

III.

AN ACT TO AMEND THE FOREST, FISH, AND GAME LAW, TO CREATE A CATSKILL PARK AND DEFINE THE BOUNDARIES THEREOF.

SECTION 1. Article thirteen of chapter twenty of the laws of nineteen hundred, entitled "An act for the protection of the forests, fish and game of the state, constituting chapter thirty-one of the general laws," is hereby amended by adding after section two hundred and seventeen another section, to be known as section two hundred and seventeen *a*, to read as follows:

SEC. 217*a*. Catskill Park.—The Catskill Park shall include all lands now owned or hereafter acquired by the state within the following boundaries, to wit: Beginning in Ulster county at the southeasterly corner of great lot five of the Hardenburg patent, thence running northwesterly along the southerly boundary of said great lot five through Sullivan county to the East branch of

the Delaware River in Delaware county; thence along the southerly bank of the said East branch of the Delaware River to the Ulster and Delaware Railroad at the village of Arkville; thence along the said Ulster and Delaware Railroad easterly to the line between the counties of Delaware and Ulster; thence northeasterly along that line to the southerly line of Green county; thence northwesterly along the southerly line of Green county to the line between the towns of Halcott and Lexington; thence northerly along the easterly line of the town of Halcott to the line between great lots twenty and twenty-one of the Hardenburg patent; thence northerly along said line to the south bank of the Bataviakill; thence along the southerly bank of the Bataviakill easterly to the west line of the state land tract; thence northerly, easterly and southerly along the line of the said state land tract to the line between the towns of Cairo and Catskill; thence southwesterly along said town line to the easterly line of the town of Hunter; thence southerly along the said easterly line of the town of Hunter to the line of the Hardenburg patent; thence easterly, southerly and westerly along the general easterly line of the Hardenburg patent to the line between the towns of Olive and Rochester of Ulster county; thence easterly on said line to the point where the Mettakahonts creek crosses the same, flowing easterly; thence southwesterly parallel with the northwesterly line of the town of Rochester to the line between the towns of Rochester and Warwarsing; thence westerly and southerly along the line of the Hardenburg patent to the place of beginning. Such parks shall forever be reserved and maintained for the free use of all the people.

SEC. 2. This act shall take effect immediately.

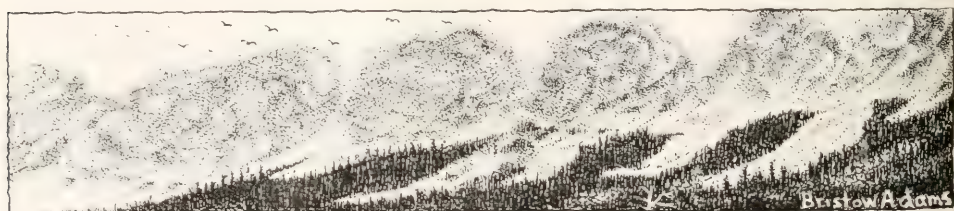
IV.

CONCURRENT RESOLUTION OF THE SENATE AND ASSEMBLY PROPOSING AN AMENDMENT TO SECTION 7 OF ARTICLE 7 OF THE CONSTITUTION.

SECTION 1. *Resolved* (if the assembly concur), That section seven of article seven be amended so as to read as follows:

SEC. 7. Forest preserve.—The lands of the state, now owned or hereafter acquired, constituting the forest preserve as now fixed by law, shall be forever kept as wild forest lands, except as hereinafter provided. They shall not be leased, sold or exchanged, or be taken by any corporation, public or private, nor shall the timber thereon be sold, removed, or destroyed. The legislature may authorize the removal of dead timber on burned areas so far as necessary for reforestation, through officers and employés of the state, but not by contract. The legislature may also authorize the sale of lands outside of the limits of the Adirondack Park and the Catskill Park as such parks are now established by law. The proceeds of such sales shall be set apart in a separate fund and used only for the purchase of lands in such parks. A violation of this section may be restrained at the suit of the people or with the consent of the supreme court on notice to the attorney general at the suit of any citizen of the state.

SEC. 2. *Resolved* (if the assembly concur), That the foregoing amendment be referred to the legislature to be chosen at the next general election of senators, and in conformity with section one, of article fourteen of the constitution, be published for three months previous to the time of such election.



Bristol Adams

SETTLERS SEEKING GOVERNMENT AID.

POSITION OF THE RECLAMATION SERVICE BRIEFLY
OUTLINED—SETTLERS MUST TAKE THE INITIATIVE.

THE operations of the engineers of the Reclamation Service since the passage of the irrigation act have excited widespread interest throughout the country. In many sections of the West irrigation has been developed to a point where the requirements of the land exceed the normal water supply, and the settlers are organizing with a view of securing the aid of the government in the construction of immense storage works to conserve the flood waters now going to waste. The assistance of the government is asked, as the cost of the work is beyond the means of the land-owners. In all such cases the policy of the Reclamation Service has been to make it clearly understood that this assistance can be secured only through the influence of a healthy and sustained public opinion expressed in a direct communication to the Secretary of the Interior from the people. In brief, the direct beneficiaries—the actual land-owners—must take the initiative and organize along lines similar to those followed by the settlers of Salt River valley.

It should be understood that the irrigation projects which naturally appeal most to the engineers are those which are free from the vexing questions of private ownership of land and water. Large enterprises which contemplate the reclamation of vast areas of desert land, yet a part of the public domain, present no obstacles aside from those of a purely physical or engineering character, while the construction of works in settled communities is sure to involve personal features often more trying than

anything found in the actual work of construction.

Just now there are several irrigation districts making appeals to the government for assistance, in order that many thousands of acres of crops may be saved from partial or total loss each year by reason of a scanty water supply. In one of these districts, the famous valley of the Uncompahgre, in Colorado, the irrigators and ditch owners have perfected an organization and will present a formal demand for federal aid in the construction of the Gunnison tunnel.

In Montana, Idaho, South Dakota, Oregon, and other states, similar organizations are forming; mass meetings are being held, officers elected, and details considered. The rule of the Reclamation Service in all such cases is one of absolute non-interference. Upon request assistance is given in outlining the proper form of organization required by the Department before definite action can be taken, but in all other essentials the settlers are informed that they must work out their own destiny; that their requests for aid must bear practically the unanimous endorsement of the actual property owners, and must be free from suspicion of politics.

Down in the forbidding Salton desert the settlers are petitioning the government to take up a stupendous work for the fuller utilization of the waters of the great Colorado River. To those making such request, and to all others who in the future may desire the government's aid, the above outline of the position of the Reclamation Service is especially directed.



Bristow Adams

FOREST PROBLEMS OF MICHIGAN.

EXTRACTS FROM A PAPER READ BEFORE
THE MICHIGAN ACADEMY OF SCIENCE.

BY

JOHN H. BISSELL.

SURELY it is a matter of the most serious concern whether the country's supply of timber is failing or not, and whether anything can be done by the individual or the state to preserve the present stocks, to replenish some of the waste and depletion of the supplies, or utilize again the waste places, where once were forests, with the same most valuable crop.

The superficial area of the State of Michigan, as given by the late Professor Winchell, is 56,457 square miles, or in acres—that being the unit most common to the thought of business people—36,128,640 acres, besides 404,730 acres of land on the islands belonging to the state, located in the Great Lakes. Total acreage, 36,533,370.

The number of small or inland lakes is something over 5,000, having a total acreage of 712,864. It may not be an unreasonable guess to say that the area covered by the cities, villages, highways, railroads, and rivers of the state occupy approximately 1,500,000 acres. Taking this, with Professor Winchell's estimate of lake areas, from the total acreage of the state, leaves 34,320,506 acres as the approximate area of the state available for agricultural and forest purposes.

The pine forests have been by far the most valuable, but the whole state was not covered with pine forests. There are twenty-three counties of the state where there was little or no pine. The approximate acreage of these counties having no pine of commercial value is 7,200,000, which, so far as pine is concerned, reduces the area of the state to 27,120,000 acres.

Of this 27,120,000 acres, a portion has been brought under cultivation as farms, mainly, of course, on land formerly cov-

ered by hardwood, but some of it land which has grown pine.

The greater part of the land which was once so rich with its stand of the finest white pine and Norway is now waste, and much of it unfit for agriculture, and, so far as we can see now never will be brought under cultivation. It is only fit for forest. Nature knew that. But we were talking about acres.

Other parts of our 27,000,000 acres were and much now is occupied by a stand of hardwood forest, and from 18,000,000 to 20,000,000 acres of it were pine. This you will see assumes that from 50 to 55 per cent of the acreage of the entire state was originally pine forest. I ask you to remember this approximate estimate of the pine area when we come to speak of the money values.

* * * * *

The early settlement of Michigan was along its southern border. The southern counties of Michigan were originally clothed with dense forests of oak, cotton-wood, poplar, black walnut, cherry, bass-wood, maple, birch, sycamore, hickory, and elm, with occasional "oak openings." All statistics, so far as we have been able to find, show that the products of the forest have been the most important factor in building up the industries and wealth of the state, and more wealth has been created from the use in industrial development of all kinds from the lumber industries than from any other. If this assertion is not true of all the states of the Union, it certainly is of Michigan, Wisconsin, Minnesota, and some of the provinces of Canada.

* * * * *

The total production of pine which we have outlined above is 161,475 million

of feet, and with the estimate given for the hardwood, cedar, etc., amounts to a total forest production for Michigan of 211,475 millions of feet. The average sale value at the point of manufacture, taken as \$13 per thousand, gives for the pine \$2,099,175,000, and the hardwood, cedar, etc., \$550,000,000—a total forest production for Michigan of \$2,649,175,000.

The pine estimate, feet . . . 161,475,000,000
The estimate destroyed, feet . . . 53,825,000,000

Total pine, feet . . . 215,300,000,000

Hardwood, cedar, etc., feet . . . 50,000,600,000
Estimate destroyed, feet . . . 16,666,000,000

Total . . . 66,666,600,000

Probable total of original forest, feet . . . 281,966,600,000

The amount of pine estimated as destroyed . . . \$699,725,000

The amount of hardwood estimated as destroyed . . . 160,000,000

Total estimate . . . \$859,725,000

* * * * *

Totaling the statistics of these thirty-eight counties, we have this result: Total acreage, 18,950,000 (about 25 per cent of the area of the entire state); area in farms, 2,460,000 acres, which is 13 per cent of the thirty-eight counties. The acreage of improved land is 953,000, or 5 $\frac{1}{10}$ per cent, and the percentage of unsettled land is 87 per cent, and the percentage of land unimproved is 95 per cent.

Of these thirty-eight counties, with 18,950,000 acres, 16,486,500 acres are unsettled, and 18,002,500 acres are unimproved.

Why are these lands unsettled and unimproved? Simply because they are, in the main, unsuited to the uses of settlement and improvement for agricultural purposes; but they have the finest soil in the world, with climatic and other conditions most favorable, for growing, not for once, but for all time, the one crop that is most needed, and it is the most valuable that these lands can grow—the white pine.

What should the state of Michigan do about it?

I. Repeal all existing land laws.

II. Acquire all pine stump lands by making absolute all titles through sales for delinquent taxes, by purchase at their actual present value, or by condemnation under the power of eminent domain all lands necessary for protection or improvement of the state's holdings.

III. The enactment of a new land law permitting no sale of public land except for actual homesteads at a fair valuation; the sale of no land until a thorough examination showed it was not needed for the state forest land; the survey and setting apart for state forest land all lands suitable by character and location, and the reclamation of the state lands by replanting and thoroughly protecting the growing forest.

IV. A policy of taxation to encourage private owners in the improvement of their holdings, and one perfectly fair to the inhabitants of the counties where the state lands are located.

In other words, the adoption by the state of a comprehensive, enlightened, and business-like public policy respecting forestry and its enactment into law

NATIONAL IRRIGATION IN WYOMING.

DESCRIPTION OF THE SHOSHONE PROJECT, WHICH IS LIKELY TO BE ONE OF THE FIRST TO BE TAKEN UP IN THE ARID NORTHWEST.

THE Shoshone project in Wyoming, for which the Secretary of the Interior has just set aside \$2,500,000, contemplates the erection of a dam 170 feet high, which may ultimately

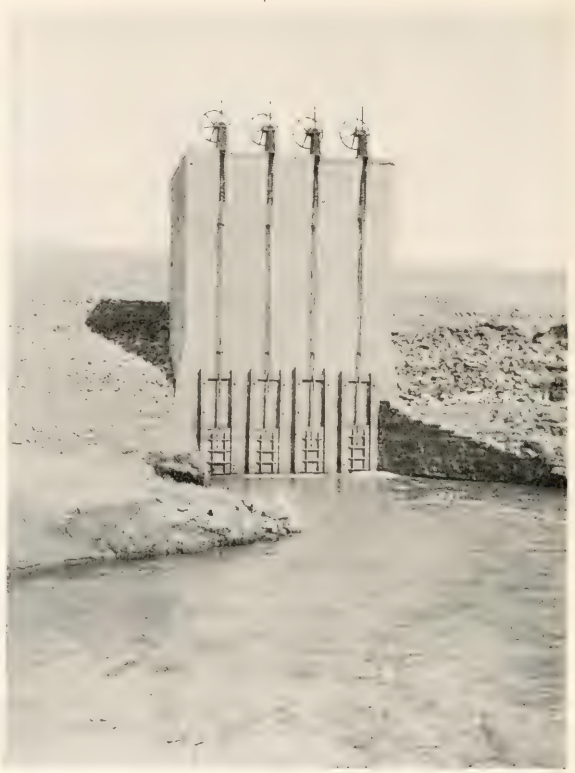
be extended to over 200 feet and which will flood about 3,500 acres. A conduit is proposed through the canyon of the Shoshone with a capacity of 1,000 second feet, to be partly in open

cut and tunnel. The canal covers the high lands and includes an area about two miles in width above the proposed Cody and Salisbury Canal. The main line terminates at Eagle Nest Creek, but can be continued on grade to carry water, if necessary, through the gap into Clark's Fork, flowing north into Montana. Smaller lines terminate at the Bad Lands north of Garland, but may be continued to cover other lands, surveys of which have not yet been finished.

The main canal crosses three ravines by means of steel pressure pipes, the details of which are being worked out. Estimates have been prepared showing the feasibility of this form of structure. The canal system as outlined covers 103,000 acres, of which about 93,000 acres are irrigable, and the surplus water may be used for irrigating lands south of Shoshone River or taken across the divide into Clark's Fork, as before stated.

It is probable that a large amount of power will be developed at various points on the canal and utilized for pumping water upon higher lands. The cost of irrigating 93,000 acres of good land, according to the preliminary estimates, appears to be within feasible limits. Extension of canal lines will doubtless be made from time to time, as the plans are so drawn as to permit of the maximum enlargement consistent with the topography of the country.

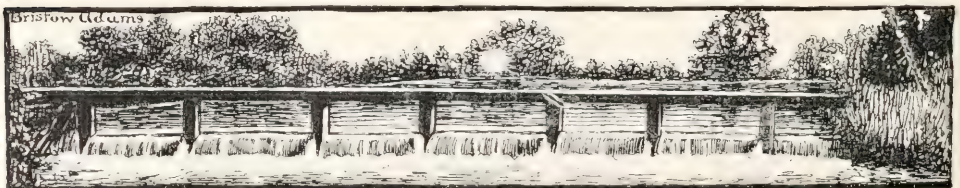
While the Secretary of the Interior has set aside two and a quarter millions of dollars for the construction of this



DISCHARGING GATES OF A WYOMING RESERVOIR.

work, dependent on securing title to the land and water and upon all the engineering details being found to agree with the preliminary plans, there seems to be no reason to doubt the early commencement of this, the first great work of the Reclamation Service in the north-western part of the arid country.

Engineer Ahern, now in Washington, who has been in charge of the preliminary work on this project, hopes to be able by early spring to put the plans and estimates in the hands of the board of consulting engineers, who will go over these matters on the ground and pass upon the various structures proposed.



GOVERNMENT FORESTRY EXHIBIT.

WHAT IT COMPRISES AND HOW IT IS
ARRANGED AT THE ST. LOUIS FAIR.

THE Bureau of Forestry of the U. S. Department of Agriculture has prepared for the Louisiana Purchase Exposition the most extensive display it has ever made. The purpose is both to illustrate the work which the Bureau is doing and to show actual forest conditions in all parts of the country. The visitor will see there the most impressive evidence of what practical forestry is, and also its great present and future importance as a means of promoting the national welfare. Lumbering ranks fourth among the industries of the country, and it is a matter of hopeful promise for the permanence of the industry and for the cause of forestry that lumbermen are adopting conservative forest management in their lumbering operations. That agriculture, incomparably the most important of our national sources of wealth, also depends in no small degree on forestry, is not, however, so well understood. Under intensive methods of farming, and with the enlargement of the cultivable area made possible by irrigation, this dependence will become increasingly close. Mining and grazing, too, materially depend on forestry, for mines demand cheap and abundant timber, and the forage which feeds most of the Western stock is one of the important indirect products which, under proper restrictions, the forest may be made to yield. All of these relationships are strikingly displayed in the forestry exhibit at St. Louis.

The space allotted to the Bureau of Forestry is in two different, though not widely separated, parts of the fair grounds. An indoor exhibit is located in the Forestry, Fish, and Game Building, in which is centered also an exhibition of the lumber industry of the United States. A striking and complete collection of photographic transparencies illustrate forest conditions and problems as they are encountered by the Bureau. Typical single trees and forests, the cutting or harvesting of forests and

their renewal by natural reproduction, forest planting in treeless regions or where forests have been destroyed, and damage by fire, insects, over-grazing, etc., are shown most clearly. Nearly all of the transparencies are of large size, some of them 4 by 5 feet. They are arranged to be seen from the inside of an arcade illuminated by natural light, with Eastern and Western forest scenes shown on opposite walls. This series is supplemented by a collection of large colored bromide photographs framed in the panels of the balustrade which surrounds the exhibit space. On the floor between the balustrade and the arcade are cases which display some specially important phases of the Bureau's investigations, together with a collection of all the instruments used in forest work, the publications of the Bureau, etc. Of particular interest is a large case containing longleaf pine trunks which show the advantages of the new system of turpentining promoted by the Bureau and the disadvantages and injurious effects of the old system of boxing. Two other cases exhibit insects and examples of their destructive work. The method of determining the strength of commercial timbers is shown by a testing machine, while the results of tests are shown by charts and tested timbers. There is also a large collection of timbers, both from the United States and Europe, treated by different preservative processes to show the manner of increasing the life of various construction timbers. Several specimens are shown of building and other timbers which have been in use for thirty years or more.

One of the special features of the exhibit is a relief map of the United States cast upon a section of a sphere 16 feet in diameter. By using this type of map the geographical distortion inevitable in flat maps is avoided, and the real relationship of the various parts of the country and their actual position on the globe are correctly shown. The distribution

and character of the forests of the country are shown in different colors, as are the location and extent of national and state forest reserves. The forests managed according to working plans prepared by the Bureau and lands upon which plantations have been instituted under Bureau planting plans are also indicated by special symbols. The situation of forest schools and other institutions which afford training in forestry is shown on the map. On another relief map are shown the location of the proposed Appalachian Forest Reserve, the extent and character of forest and other lands included, and the relation of the reserve to the surrounding country.

The outdoor exhibit of the Bureau is on a tract of $2\frac{1}{2}$ acres situated about 300 yards southwest of the Forestry, Fish, and Game Building. Here are displayed, on and about a model farm, forest plantations suited to every part of the United States, practical forest nurseries, and the best forms of windbreaks which are so important for protection of the western farmers' crops and buildings. The coöperative work of the Bureau in this direction has been very successful, and this exhibit is certain to attract much interest among visitors from the regions in which forest planting has proved its usefulness, both for protection and as a means of providing local supplies of fuel and timber. During the past five years plans for such planting have been put in operation under the direction of the Bureau of Forestry on 210 western farms. The model farm represented comprises a quarter of a section of prairie land laid out on a scale one-tenth the actual linear measurements, to show a model plan for planting trees in a treeless country. Forty-seven forest blocks surrounding this area illustrate pure forest plantations and various methods of mixing tree species. In each of these blocks the trees are given the actual intervals recommended for planting in the

different regions to which the illustrations apply. Methods of growing nursery stock from cuttings, transplants, and from seeds are fully illustrated, as are the various styles of screens used for shading coniferous tree seedlings. The cultivation of four varieties of basket willow is also an interesting feature of the outdoor exhibit. Fields, farmsteads, etc., are laid off with growing trees planted along the fence lines and about the home lot.

In addition to the displays described, the Bureau of Forestry will coöperate with the Department of Mines and Metallurgy in a series of comparative tests relating to the best methods of preserving timbers. For this purpose a complete experimental treating plant, consisting of a small cylinder, vacuum, and pressure pumps and tanks for holding the preservative solutions will be in operation on the outdoor tract of the Department of Mines and Metallurgy. Other plants will show the application of the Giussani and Rüping processes. It is expected that one or more runs will daily be made, when ties and timbers from all parts of the United States will be treated. Close to these experimental plants will be found a cylinder whose operation illustrates the best methods of increasing the longevity of fence posts. In a separate building near the treating plants several testing machines will be operated by the Bureau of Forestry for the purpose of determining the strength of different timbers treated by various preservative processes.

The greatest effort has been made in the preparation of the government forest exhibit to give as complete an exposition as possible of the purposes and work of the Bureau. The result, it is hoped, will be peculiarly interesting and instructive to that vast body of citizens whose material welfare is so intimately connected with the adoption of practical forestry.



FOREST FIRES IN MINNESOTA IN 1903.

EXTRACT FROM NINTH ANNUAL REPORT OF THE CHIEF
FOREST FIRE WARDEN OF MINNESOTA: EXPLANATION
OF THE SYSTEM, WITH ITS COST AND EFFECTIVENESS.

ALTHOUGH wet weather prevailed during the latter part of the summer and in the season of harvesting, there were dry spells in the spring and late autumn. The number of forest fires reported by the fire wardens was 52, which burned over an area of 15,585 acres and did damage to the amount of \$28,292. At 27 of these fires, being a little more than half, a fire warden was present to assist in extinguishing and controlling the fire. Of these fires 11 were caused by clearing land, 9 by railroad locomotives, 7 from other known cause, and 25 originated from causes unknown.

The number of prairie fires reported was 35, which burned over 26,308 acres and did damage to the amount of \$4,666. At 14 of these fires a fire warden was present and assisted in extinguishing and controlling the same. They were caused, 9 from burning brush, straw, or stubble; 4 by railroad locomotives, 3 by hunters, 6 from other known causes, and 13 from causes unknown.

PROSECUTIONS.

There were eight prosecutions for causing forest and prairie fires, and four convictions obtained. There is naturally great reluctance on the part of fire wardens to prosecute their neighbors or fellow-citizens for carelessness in causing fires.

RAILROAD RIGHT OF WAYS.

Section 12 of the fire-warden law requires railroad companies (which, of course, includes logging railroad companies) to keep their right of way to the width of 50 feet on each side of the center of the main track cleared of combustible materials. This is found to be a rather difficult provision to enforce. While some roads are kept cleared of combustible material in an exemplary manner, there are companies which are habitually neglectful in this regard.

The local service, in preventing and fighting fires, both forest and prairie, is rendered by the town supervisors, who are *ex-officio* fire wardens, and by those whom they summon to assist, and in unorganized territory by fire wardens specially appointed. This service is paid for in the first instance by the counties in which it is rendered, and the state pays to the counties two-thirds of such expense. Up to last year the state paid to the counties only one-third of such expense. It is expected that the counties now will be more prompt and liberal in paying such service. In an ordinary year it may be assumed that the two-thirds of expense the state has to reimburse to the counties will amount to \$4,000. The other expenses pertain to the office of chief fire warden, and include his salary, clerk hire, traveling expenses, postage, printing of (12,000 in muslin) warning notices, blanks, circulars, etc., and an edition of 4,000 copies of his annual report.

MONEY APPROPRIATED.

"The item to cover all these expenses," says the chief fire warden, "is found in the general appropriation act under the head of 'Forest Preservation,' and I think the public will be surprised to learn that it amounts to only \$5,000. It is an amount—I will not say wholly—but very inadequate for the efficient execution of the law."

Nobody knows when an exceptionally dangerous season may occur. It will not do to wait until it has come. Every spring the local fire wardens in about six hundred towns must be furnished with notices, instructions, and blanks and kept on the alert, so that in case a drouth should occur they will be active in preventing dangerous fires. The economical use of money is in the prevention of fires.

The province of Ontario expends \$30,000 and upwards a year in the pre-

vention and extinguishment of forest fires.

This report further states that the standing timber in Minnesota is worth easily \$100,000,000, and it is this property which the fire-warden system seeks to protect. The state itself owns 2,500,000 acres of land, a part of which is forested and protected by the fire-warden system. The state last November sold \$600,000 worth of timber from its own land, and has in all received \$4,000,000 for just the timber sold from exclusively its lands which it received as a gift from the United States. The state will continue for many years to sell timber of various kinds from these lands, and is on this particular account deeply interested in preventing damage by forest fires.

THE ORIGINAL PINE FORESTS DISAPPEAR.

One of the richest pine timber regions of the Northwest was the Saginaw and Huron Shore districts of Michigan. In 1893 there were cut in that district 858,000,000 feet of pine; but the supply of pine timber had so diminished during the next ten years that in 1903 only 52,000,000 feet were cut. The number of feet of pine logs cut in Minnesota the season 1902-1903 was 2,000,000,000. The amount of pine lumber cut in the year 1903 by the mills in the districts of Duluth, Minneapolis, above Minneapolis and St. Croix, was 2,200,628,000 feet, being over two billion feet. A comparatively small amount of this may have been from the forests of Wisconsin. A liberal estimate places the remaining standing pine in Minnesota at 28,000,000,000 feet. Any one can judge for himself, therefore, how soon this forest capital

will be exhausted and say whether it is not time to begin a system of reforestation by utilizing waste land in the production of pine timber.

WHAT FORESTRY MEANS FOR MINNESOTA.

What forestry means for Minnesota is simply this: The remaining original pine timber will be cut in the next fifteen years. Some second growth pine, if protected from fire, will then be cut from year to year, but it will not be as good as the original growth and there will not be enough of it for home consumption. Lumber will be dearer and our great lumber industry will decline. There are, however, fully three million acres of waste land in scattered localities, which if planted with pine would in time become normal forests, yielding forever a supply sufficient for home need. Such forests would by their growth perpetually yield a net annual revenue on the capital invested of three per cent, compound interest, besides many indirect benefits. On such waste, sandy land it will take on an average about eighty years for a crop of pine trees to grow to merchantable size. Individuals can not wait so long for a crop and they will not engage in the business. The state, to whom time does not matter, must undertake the work by purchasing waste land and planting it with pine.

The report gives an abstract of the recent laws of different states for preventing forest fires, discusses practical forestry, argues that the state will gain honor as well as money by treating its forests and waste land with scientific care, furnishes sketches of European forestry, and contains several original illustrations of Minnesota forests.



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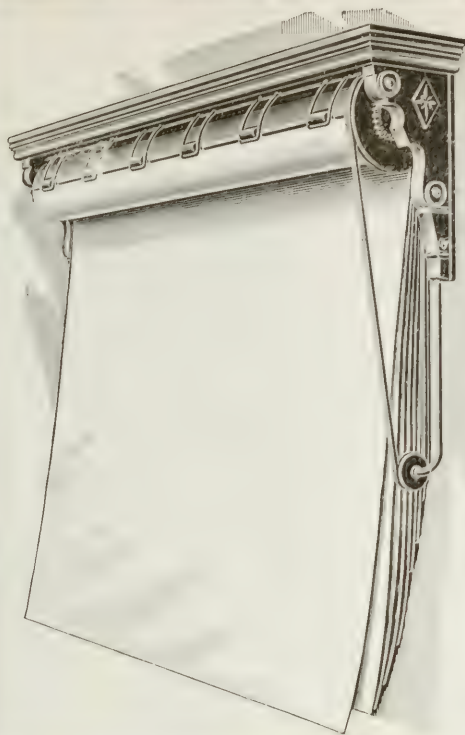
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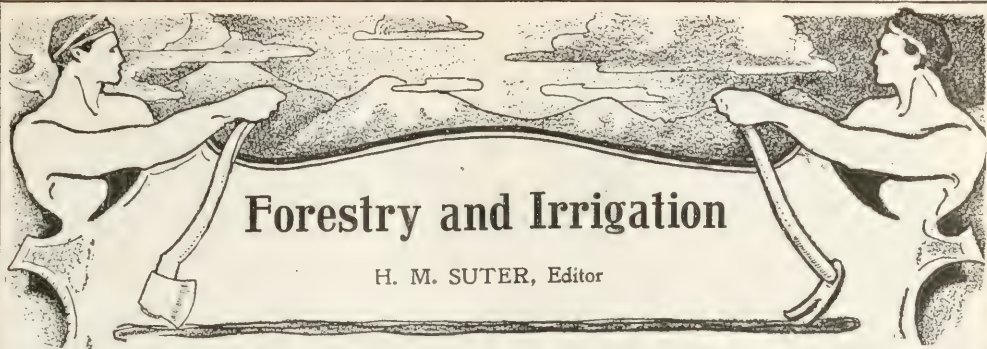
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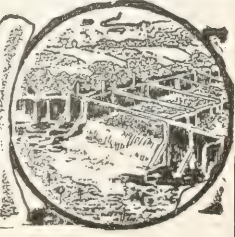
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THE BLACK CANYON OF THE GUNNISON RIVER, COLORADO, AT THE PROPOSED DAM SITE OF THE UMCORPAHGRE IRRIGATION PROJECT. CANYON WALLS 2,700 FEET HIGH.

Forestry and Irrigation.

VOL. X.

JULY, 1904.

No. 7.

NEWS AND NOTES.

Forest Fire Record.

Newspaper reports indicate that the forest fires mentioned as prevalent in northern Minnesota and Wisconsin in last month's FORESTRY AND IRRIGATION have become inactive, principally on account of heavy rains throughout the threatened territory. These fires had been steadily burning for several weeks, and the losses, while not large, have been quite severe to a number of farms in the burned section. In California intense heat and long-continued drouth were the agencies that contributed toward the starting of several forest and grain fires, actively assisted by the omnipresent locomotive spark in most cases. On June 13 a destructive blaze was reported on the Tejon Ranch, about 50 miles from Bakersville, Cal., but it is stated that the losses comprise grain and feed rather than timber. Similar fires occurred in the Tehachapi Mountains near Bealville, with comparatively little damage to timber. Grain fires have been frequent and in some cases entailed severe losses, especially near Honcut, Butte county, Dunnigan, Yolo county, and in Colusa county.

Logging firms and lumbermen generally suffered considerable loss through forest fires distributed throughout Washington. The state has a new fire law, providing severe penalties for non-observance of certain safety regulations, and strong effort is being made by the authorities to secure its rigid observance. The losses to date, says the *Seattle Post-Intelligencer*, are estimated to be not far from \$350,000, \$150,000 of which is estimated to have been lost through the destruction of timber and lumbering outfits by forest fires in Snohomish county. No further danger is at present appre-

hended, however, as it is thought that the excessive rains of recent date will have effectually extinguished all signs of fire. The King County Commissioners, who are empowered to act as an *ex officio* Board of Deputy State Forest Fire Wardens, have issued the following warning to the public, together with rules governing the deputy wardens, which will be rigidly enforced during the next three months:

"Any person, firm, or corporation firing or burning any slashing or chopping during the close season without first obtaining permission from the forest fire warden of King county will be prosecuted as provided by law. Before any permission will be granted the applicant must give notice to all owners, tenants, agents, or representatives of adjoining lands, giving the time and place of the proposed burning, and on presentation of proof that such notice has been given permission will be granted after the expiration of three days.

"The forest fire warden shall inspect all logging engines, locomotives, and farm engines, and see that they are properly equipped with spark-arresters as provided by law and report any neglect to the prosecuting attorney."



Water Power Survey.

The appropriation of \$1,500 recently made by the New York State Legislature for coöperative hydrographic work with the United States Geological Survey will be used in maintaining records of the rise and fall, the ordinary outflow, floods, and drouths of many streams in the state. By means of these records it is possible to determine in specific cases the water supply

available for canals, public water systems, and water power. The conditions of streams in more than fifty places in the state is regularly reported.

The work has gradually grown until there is at present hardly a section of the state in which some river is not systematically measured. The list includes Chemung, Allegheny, Susquehanna, Chenango, Catskill, Delaware, Hudson, Mohawk, Saranac, Oswegatchie, Genesee, Oneida, Seneca, Oswego, and Black rivers, and their most important branches. The developed water power of these streams amounts to nearly 300,000 horse power, and they afford an almost unlimited amount of undeveloped power.

Mr. Robert E. Horton, hydrographer, of Utica, N. Y., has charge of the work.

Reclamation Engineers. From September 15 to 18, 1903, a conference of the engineers of the Reclamation Service was held at Ogden, Utah. At the time of this meeting the Reclamation Service had been in active operation for over a year and projects in each state had reached a point at which their relative merits demanded consideration. It was therefore deemed advisable to bring the principal engineers together, in order to discuss somewhat informally the methods and results of work. The eleventh irrigation congress was in session then at Ogden, and delegates were in attendance from the thirteen states and three territories named in the reclamation law, as well as from Texas and the country farther east. The engineers of the Reclamation Service were thus enabled to meet public men and others who are interested in the work of irrigation and to exchange views freely with them. The proceedings of this conference of reclamation engineers, compiled by Mr. F. H. Newell, chief engineer, have been recently published by the United States Geological Survey as No. 93 of its series of Water Supply and Irrigation Papers, a volume of about 350 pages filled with valuable data. Besides the purely technical discussions and addresses, the paper includes several interesting speeches

made to the engineers by various governors, senators, and other prominent people. It is published for gratuitous distribution, and may be obtained by application to the Director of the United States Geological Survey, Washington, D. C.

Forest Reserve Personals. David H. Hunsecker, who has been employed as a first-class ranger on the Lewis and Clarke Forest Reserve, has resigned.

Charles F. Cooley has been appointed forest supervisor of the Grantsville Forest Reserve, recently created.

Three additional rangers have been appointed to serve on the Fish Lake (Utah) Forest Reserve under Forest Supervisor C. D. Balle. Considerable territory has been recently added to this reserve.

The headquarters of the supervisor of the Wichita Forest Reserve in Oklahoma has been changed from Orana to Cache.

Supervisor R. C. McClure has been off duty attending his daughter, who is seriously ill at Santa Fé, New Mexico.

Forest Ranger John M. Simpson has been transferred from the Pikes Peak Forest Reserve to serve as first-class ranger on the Pecos River Forest Reserve, New Mexico.

Thomas F. Meagher, who has been serving as forest ranger on the Gila River Forest Reserve, has been transferred to the Santa Catalina Forest Reserve and promoted to forest supervisor of the latter reserve.

Intensified Farming. A recent editorial in the San Francisco *Chronicle* on "Intensified Farming" is worth reprinting. It calls attention to a matter that deserves the close attention of the farmer in humid areas as well as the regions where irrigation is practiced.

"There is something foreshadowing the future in a little story that has come from Fort Pierre recently. It tells of old ranchers in that region who are farming or gardening in patches of from five to seventy-five acres this year.

They report their corn, oats, and garden stuff to be in fine condition. One reports a wonderfully productive garden, another a good stand of alfalfa—only five acres of it—and so on. The story is one of intensified and diversified farming.

"Soon we shall find the entire West taking up the idea, and with irrigation it will be not only practicable, but highly profitable. The exhaustion of our non-arid public domain compels the settlement of the remaining portion, and there must be irrigation before there can be successful settlement. At the same time irrigation makes intensified farming profitable, for under irrigation there is often more productiveness in forty acres than there is in a whole section where the farmer must depend upon the weather and stand total or partial crop losses two years in five.

"If there is a tendency to intensive farming where there is no irrigation, it is safe to predict that not many years will elapse before the range country is broken up into irrigated farms of a comparatively few acres each wherever irrigation is possible, and Congress can hasten the day by turning a deaf ear to the cattle kings and timber barons and legislating in the interests of the plain people, who are anxious to make homes for themselves.

"Congress has fought shy of this question of preserving the remaining fragment of public domain for the people, but public opinion will surely force a repeal of the laws making monopoly possible and small individual proprietorship impracticable before all the public land has been given to the 'barons.' "



Forest Progress in Indiana.

The recent inspection of Indiana's forest reserve in Clark county has brought about some very interesting facts in regard to the work that has been done there and regarding work that is laid out for the coming few months.

When the board, the members of which are President F. C. Carson of Michigan City, Albert Lieber of Indianapolis, Stanley Coulter of Lafayette, John Cochran of Indianapolis, and Sec-

retary W. H. Freeman of Indianapolis, visited the reserve last Tuesday they were, with the exception of Mr. Freeman, greatly surprised at the work that had been done. Mr. Freeman, by close economy and careful attention to each detail of the work, and personal inspection of the land, has succeeded in transforming a part of Hoosier wilds into a park.

Last year at this time the land was in as dilapidated a condition as old fences, buildings, underbrush, and none-too-careful attention could make it. At that time there were no roads through the reserve. At the present time the reserve is carefully cleared, and many trees have been planted over ground that was formerly given to crops of corn and such truck as was grown in that section of the country. Winding among the hills are roads, by which the inspection party was able to see almost all the improvements from a carriage. The buildings which were formerly on the land have been removed and all parts of the reserve are now ready for the work of planting and attending the young trees.

The planting of 10,000 white pines on the knobs was completed, and everything is now practically ready to work on the newly cleared and prepared ground. In speaking of the work which will next be taken up, Mr. Freeman states that there are 250 acres of the reserve which will be worked over from September to December. This land will be planted with hardwood trees, including walnut, hickory, beech, and ash, with some poplar and similar trees. The final details in preparing this ground will be taken up with the beginning of this week. The patrolling of the land has already commenced and will continue during the summer and fall.

To the Clark County sportsmen the reserve offers a tempting hunting ground. Squirrels are already finding a safe retreat and plenty of quail and other feathered game are becoming plentiful in the woods. Although the law does not permit the shooting of squirrels until August, they are already being killed in the south part of the state, and it is the duty of the patrol to see that none of the little animals are molested on the reserve.

Michigan Students' Trip.

The seniors in the forestry courses at the Michigan State Agricultural College recently made a trip to the pine lands in the northeastern part of the lower peninsula, visiting several wood-working factories en route, free transportation having been furnished north from Bay City by a railroad company interested in forestry.



Huge Irrigation Enterprise.

Announcement has been made that work will be begun immediately on the completion of the water system of the California Mountain Water Company, of which John D. Spreckels, of San Francisco, is president. This system already consists of two large reservoirs, the Lower Otay and the Upper Otay dams, which impound many billions of gallons of water, and the work remaining to be done consists of constructing the Barrett dam at Morena, the building of the conduit to carry the water from there to the Lower Otay dam, and the laying of the pipe line from Bonita to this city.

The cost of the work now to be undertaken will be more than \$2,000,000. The watershed tributary to the Barrett reservoir has the greatest rainfall of any section south of San Francisco, and with the system completed there will be ample water supply for a city several times the size of San Diego. The average rainfall in that section is about forty inches a year. Thousands of acres of agricultural land will be brought under irrigation, and the towns of National City, Chula Vista, and Otay will be supplied.

The announcement that this work is to go forward at once and as rapidly as possible is regarded as one of the greatest events in the development of San Diego.



Nebraska Forest Students.

In the University of Nebraska about thirty men have been in the courses in forestry the past year, a very good showing for the second year of its establishment. At

the recent commencement three men completed the forestry work and were graduated with the degree of Bachelor of Science (in forestry). These men had been taking work in other scientific courses, and on the establishment of the forestry courses were transferred to the latter, which they completed in two years. The full course is four years in length, and entrance to the freshman class requires the same preparation as for the scientific or literary courses. The students in advanced classes in forestry in the University of Nebraska spent a month this spring on the Dismal River Forest Reserve, at work under the direction of the Bureau of Forestry officers. They helped in the work of planting the sand hills with seedling pine trees.



Benefit of Hydrographic Records.

The parable of the sower is applicable to all educational work. Much of the mission of the great departments maintained by the government, especially the scientific bureaus, is educational in its nature. The government is in the position of a progressive and ambitious instructor in a modern college, who, surrounded by every laboratory and library facility, spends part of his time in making original investigations and part in communicating to his pupils the results of his studies. The seed he sows falls on all kinds of soil, but, however poor the ground, it is sure to bring forth fruit in some measure, if there is life in the kernels that he sows. There is great variation in the returns from the different kinds of educational work prosecuted by the government. The ultimate value of much of it can be determined only after the lapse of many years, but some of it seems to bear fruit a hundred fold from the very start. An instance of this is seen in the results that have followed the hydrographic work of the U. S. Geological Survey in many quarters. The cases in which it has been a benefit to the one State of Colorado, for example, are numerous and interesting.

None of the irrigation work contemplated by the government would, ordinarily, be possible without long delay,

were it not for the hydrographic data accumulated by the Survey during many years of observation and measurement. In addition to that, the work of private individuals is constantly facilitated by the same records. No large engineering enterprises are now undertaken without reference to the Survey's records concerning the supply of water available at the chosen site. The South Platte Land and Reservoir Company, which has under way canals and reservoirs that probably aggregate \$500,000 in value, has established stations at Orchard and Kersey, Colorado, because of the superior hydrographic advantages offered by those localities. The choice of those points is directly traceable to the data compiled by the Survey. Equally important is the fact that projects that would have resulted disastrously have in numerous cases been abandoned after a study of Survey records that threw light on the probable outcome. Data concerning the flow of water on the Arkansas and South Platte rivers prevented the expenditure of great sums of money on the state canal in the first

instance, and upon the Pawnee Pass reservoir project in the second.

Survey data seem to be in great demand as unimpeachable testimony in the legal controversies that have arisen in this state in regard to irrigation matters. A most notable instance is the case of the Colorado and Southern Railroad *vs.* The Denver Union Water Company, in which the sum of \$100,000 was involved.

Data obtained by the Survey in regard to the amount of water power available at certain places have influenced the plans of the Glenwood Springs Light and Power Company, the New Century Light and Power Company, and also proposed power companies on Clear and St. Vrain's creeks. None of these projects has yet been carried to a conclusion, but some of them will undoubtedly be eventually constructed.

Colorado cities seeking a suitable water supply have frequently consulted data obtained by the Survey. In the case of Durango, in southwestern Colorado, the discharge of Florida River was



AN ARTESIAN WELL IN THE WESTERN IRRIGATION COUNTRY.

especially studied in order to ascertain whether a gravity water system would be feasible at that point.

The location of various manufacturing industries has been determined by reports from Survey engineers on the available water supply. Conspicuous instances of this are the construction of the American Beet Sugar Company's plant at Rocky Ford and the erection of the sugar factory at Loveland.

Cutting Trees by Electricity. It is reported in the German press that successful experiments have been made in various forests of France in cutting trees by means of electricity. A platinum wire is heated to a white heat by an electric current and used like a saw. In this manner the tree is felled much easier and quicker than in the old way, no sawdust is produced, and the slight carbonization caused by the hot wire acts as a preservative of the wood. The new method is said to require only one-eighth of the time consumed by the old sawing process.

Salt River Water. Mr. M. O. Leighton, chief of the Hydro-Economic Division of the U. S. Geological Survey, has been making an investigation to determine the quality of water for irrigation in Salt River above Tonto dam, and to ascertain whether the influx of salt is general, or whether it is derived from one or more isolated points.

This information is believed to be important by reason of the fact that if it is found that the source or sources of salt are isolated or local in character, steps might be taken to eliminate them from the river by well-known means determined according to the conditions in each case.

This investigation has been conducted during the period of low water in the river, because at that time the stream contains foreign ingredients in as large a proportion as is likely to be found at any other season, and the results which are arrived at will be typical of the most unfavorable conditions. Deductions made therefrom, therefore, will

probably err upon the side of safety by a wide margin.

It was found that the amount of chlorine in Salt River water is very high. At the dam site the results from the main stream were 1,360 parts of chlorine to the million, and at other points upstream for a distance of 53 miles it varied from 1,600 to 1,850 parts. The results obtained prove clearly that the salt in Salt River water is not derived from any definite source or sources, but is carried in by the general influx throughout the region. At the outset it was believed that the greater part of the salt came from what is known as the salt beds and the salt springs which are located along the river some distance below the mouth of Cibicu Creek, where there is an extensive outcrop of sodium chloride and calcium carbonate. It was found, however, that these salt beds have little or no effect upon the salinity of the water, and Mr. Leighton is inclined to believe that the entire country is underlaid by a deposit of which the salt beds are an example, the only difference being that at the salt beds the saline stratum outcrops upon the bank of the river.

The amount of salt found in the water along the entire reach of the portion of the river investigated varies surprisingly little. The influx of fresh water from the various creeks does not affect the amount of salt in the river to any appreciable degree, although tests show little or no salt in their waters, the amounts varying from 10 to 60 parts a million.

Probably the effect of the contributions upon the stream from these tributaries would be more apparent if they carried any considerable amount of water, but at the present time they are very low.

A review of the results of the investigation indicates that the salt in the waters of Salt River is derived from no local sources, and that it would be impossible to change in any relative degree the amount in the stream. Whatever may be done in connection with the improvement of the water of Salt River for irrigation purposes, it will be necessary to accept the water in its original

saline conditions. It is expected that the storage of the flood waters behind the Tonto dam will have an important effect in reducing the amount of salt in the water used for irrigation. To ascertain definitely this fact, a series of periodical salt determinations will be made in the river water at the dam, especially during flood periods. Careful study will also be made of the evaporation in the region of the dam in order to discover what may be expected in the way of concentration during the periods of low water, or when the flow from the reservoir is equal to or greater than that contributed by the drainage area.

From rough preliminary calculations it seems probable that with a reservoir full of flood water containing only a small proportion of salt it would require many months of concentration by evaporation and further contributions of strongly saline water from the contributing basins to produce in the waters of the reservoirs a salinity equal to that now present in the stream.

The waters of Tonto Creek and Verde River are comparatively sweet, and the degree of dilution which will be present will have an important bearing upon the water as it is distributed to the irrigated lands in the Salt River Valley. Calculations in this direction will be made as soon as data with reference to the flow of these streams are collected. These three features contribute the most important factors in determining the effect of the salt in Salt River upon irrigated crops.

Public Lands Commission. Mr. Frederick V. Coville, botanist of the U. S. Department of Agriculture, and Mr. Albert F. Potter, grazing expert of the Bureau of Forestry, are now in the southwest making a careful study of the grazing interests for the information of the Public Lands Commission.

Mr. Coville is giving special attention to the grazing lease systems now being applied to state, railway, and Indian lands, with a view of determining whether or not any of these systems can be applied to the public lands.

Along with this work, he is also studying whether by some new system of management the condition of the ranges can be improved.

Mr. Potter's work deals more with present methods of handling live stock on the range and in securing information in regard to the classification of ranges—that is, determining which should be classified as summer and winter ranges, as well as the further division as to which are best suited for cattle or sheep. His work is carried on wholly with a view of determining the more practical means for the control of ranges generally, which is a subject of prime importance to the grazing interests, and one which the Public Lands Commission is going into very thoroughly.



Remarkable Natural Dam. At Marble Falls, Texas, Engineer Thomas U. Taylor, of the U. S. Geological Survey, reports a

remarkable natural dam in the course of the Colorado River. The formation of limestone rocks has constructed a dam where a fall of 12 feet has been utilized to pump the water supply for the city.

From the present lake level above the falls to the head of the tail race there is a fall of 16.4 feet; to the end of the tail race, or to the tail-race pond, a fall of 19 feet; to the pond under the highway bridge, a fall of 21.60 feet. A small outlay of money would increase the head fully 5 feet without raising the crest of the dam. From the lake under the bridge to the bend in the river below there is a fall of 12.80 feet, or a total fall from the lake of 35.40 feet, and to a point 1.25 miles below the dam there is a fall of 47 feet.

There are two ways in which the power could be materially increased: (1) By excavating the tail race to the lake under the bridge by cutting it down at the head four and a half feet, which would give an effective head of 21 feet; (2) by raising the crest of the present dam by the cheap construction of a dam on the crest of the present natural dam from 4 to 12 feet, giving a maximum head of 33 feet. The minimum flow found in recent years was 160 second-

feet, which could develop 480-horse power if all the flow were used, with a head of 33 feet. A water power of 600-horse-power capacity could be inaugurated at this place, the only expense being the construction of a tail race and erecting the power plant, and raising the present lake level 12 feet. This would involve the purchase of a small tract of submerged land.

There will certainly be a big demand for the power in the future. Granite Mountain is only 2 miles away, and is right along the tracks of the railway. By combining the water power and the granite industry, a corporation could command the best and most economical manufactured output. Marble Falls offers greater possibilities for water power than any other point in Texas.



Irrigation and Power Development.

The great problems in irrigation now being worked out to practical conclusions by the U. S. Reclamation Service involve some features not observed by people generally. Chief of these is the possibility of extensive development of power in connection with the storage of water in large reservoirs or the diversion of streams into canal systems.

Many immense dams are to be built, some of them 200 feet or more in height, and when water for irrigation is drawn from the great artificial lakes so produced, incidentally an enormous amount of water power becomes available. It is proposed to erect power plants at many localities and transmit the power electrically over distances aggregating hundreds of miles to other localities where the power can be utilized for pumping water from deep wells for irrigation and domestic purposes. Thus the water which is impounded in the reservoirs and diverted from the streams is made to perform a double duty, primarily, by its direct application to the irrigation of land, and, incidentally, by furnishing the power for lifting from underground sources additional water supplies.

The construction of these great irrigation works requires the use of much machinery and the transportation of large

quantities of materials. Usually this construction work has to be carried on in places remote from railroads and other bases of supplies, where the cost of labor, teams, and fuel is abnormally high. To meet this condition, power is frequently obtained from a stream close at hand by means of temporary dams, power canals, etc., and applied to the work of excavating, quarrying, hoisting, hauling, and lighting. Thus many short electric railroads will be constructed between the great irrigation works and the nearest railroad stations, which will be useful, when the construction work is completed, for affording easy access to the completed works.

Whatever power in excess of that required for pumping purposes is obtainable from the national works of irrigation, it may serve for operating street railways and electric lighting in the communities which have grown up as the result of the government's work in supplying water to lands previously uninhabitable. These great works will, after the lapse of a limited time and upon the return to the government of the money expended on construction, become the property of these communities, and any revenue derived from the sale of power obtained in the process of storing and distributing irrigation water would serve to offset in part the operating expenses of the irrigation system.

Since these reservoirs frequently must be built far up in the mountains near the headwaters of streams, it will often happen that power can be advantageously supplied to adjacent mines, where power is especially valuable on account of the difficulties in transportation of fuel to these inaccessible localities.

On a few of the larger projects—for instance, those contemplating the control of the great Colorado and Snake rivers—the magnitude of the power development possibilities suggests the feasibility of operating considerable portions of the great railroad lines crossing these sections of the country by electric power obtained from water plants built in connection with the great dams required for the control of these mighty rivers.

Nebraska Meeting.

The annual summer meeting of the Nebraska Park and Forestry Association was held at York, Nebraska, June 14 and 15. The attendance was not large, but the program was good, and a lively interest was manifested in forest subjects. Frank G. Miller, Chas. A. Scott, and Wm. H. Mast, of the Bureau of Forestry, each presented subjects bearing upon the work the Bureau is doing in that state. A committee was appointed to look into the possibility of securing land in the Pine Ridge region of northwestern Nebraska for a state park and forest. The Pine Ridge country is very picturesque, and in many places there is a good stand of timber, but much of it is being destroyed by indiscriminate cutting. If a few thousand acres of this timber land can be bought at a reasonable price, it is hoped the state legislature may be induced to buy it for the purpose mentioned.

North Dakota Artesian Belt.

Chief Engineer Newell, of the Reclamation Service, recently received a letter from the president of the North Dakota Irrigation Congress relating to the development of the artesian basin of North Dakota, and asking that hydrographers be sent to ascertain the possibilities of artesian well development in the western part of the state for the purposes of irrigation.

It is believed by the people of North Dakota that there is a strong artesian basin or flow underlying the whole state which might be touched by wells of various depths.

Under the direction of Engineer N. H. Darton, investigations have been carried on of the underground water resources of the eastern portion of North Dakota, and it is hoped during the coming season provisions can be made for an investigation of the artesian possibilities of the western portion of the state.

It is believed that the main artesian flow west of the Mississippi River in this state lies entirely too deep to be of service either for irrigation or domestic purposes. Small flows appear to be obtainable locally from the Laramie sand-

stones, but their volume, so far as now known, is too small to give promise of being serviceable for the reclamation of public lands. The importance of this matter, however, is fully appreciated by the Service, and it will be given careful consideration.



Irrigating Indian Lands.

The recent action of Congress in passing Senator Bard's amendment to the Indian Bill has put another definite task upon the Reclamation Service. The Secretary of the Interior is now authorized to subdivide and utilize the Indian lands along Colorado River. The reclamation of the country adjacent to what has sometimes been called "the great American Nile" is thus assured.

The plans to irrigate these lands have long been regarded with special favor in southern California. The chambers of commerce in Los Angeles and other cities were indeed nothing loath to urge Congress to take prompt action in the matter.

The passage of Senator Bard's amendment is especially interesting, as it is now possible for the Secretary of the Interior to carry out an agreement made with the Indians years ago, to the effect that their lands might be subdivided and irrigated by a private corporation. Suitable laws were passed, but the company failed to build the works, and the Indians have been waiting for other relief. From time immemorial they have been accustomed to cultivate the lands along the river in spots wet by the natural overflow. These areas have now passed into the hands of the whites. All that is left the Indians is desert land that, without water, is valueless. With water, however, it can be made to produce several crops a year. Under the amendment to the Indian Bill, relief has finally come to the impoverished Indians.

The Secretary of the Interior is now free to build the necessary canals under the terms of the reclamation law, and to allot to each Indian five acres of land with water. He need not wait on any private corporation. As the Indian families average from five to six persons,

this would give them ample lands for their support, judging from the experience of the Mormons in Utah, where the average irrigated farm is less than 30 acres. The lands not utilized by the Indians are to be opened to white settlers who will pay for them. Under the terms of the reclamation law the sale of lands will serve to defray the expenses of the irrigation works, payment being made in ten annual installments. Southern California and adjacent portions of Arizona should be benefited by the influx of settlers which is sure to follow the irrigation of the land.



Eastern Nebraska Timber. For several seasons the Bureau of Forestry has been making a careful study of the timber resources of Nebraska. This study will be carried still further this summer. The survey in the western portion of the state has been completed, and reports on it are now being prepared. A direct result of the work in western Nebraska has been the establishment of the Dismal River and Niobrara Forest Reserves, comprising some 212,000 acres in the sand hills. These two reserves have been surveyed, and planting operations are under way on the former.

Considerable work has also been done in eastern Nebraska from time to time, and a party under Mr. Frank G. Miller, of the Bureau of Forestry, will continue the investigation the present field season. The territory to be covered includes all that part of the state lying east of the ninety-ninth meridian. Mr. Miller is now in the field making preliminary preparations for the investigation, and his party will follow about July 1. It is expected that the field work will be completed by October 1. The data collected in the meantime and the notes now on file concerning this region will be brought together in one report.

The investigation will include a careful study of both the natural and planted timber. Nebraska is credited with having more than 200,000 acres in forest plantations, by far the larger portion of which lies within the region to be covered by the study. Note will be made

of the character of planting done in the past, with a view to determining the most profitable species for future planting in the same localities. A great number of measurements in commercial plantations will be made to get an estimate of the yield in cordwood, posts, ties, poles, etc., that may be expected from a planted grove of a given species in a specified time. The information thus obtained will be of great value to farmers on the plains, since it will give them a basis for judging accurately how much planting they must do to supply their domestic needs, and what kinds of trees will in the long run prove most productive for different purposes.

The study of the natural forest growth will include a classification of the trees and shrubs, together with notes on their distribution. Special attention will be given to the extension of the natural timber areas. Those who have given this question careful thought find striking evidence of the rapid advance of woody growth to new ground. Cases are known where natural timber belts have extended up ravines for two miles in eastern Nebraska within the last thirty years. This tendency is marked throughout the eastern portion of the state. The investigations this summer will give an excellent opportunity for further study of this most important phase of forest extension.

The field party, which will consist of six men, all of whom are college or university graduates and in addition have had special training in forestry will be outfitted at Lincoln. Two parties of two men each will travel overland by team, and will have special charge of the study and measurements of plantations. A fifth man will be equipped with a saddle horse, and will give his attention more particularly to an examination of the natural timber resources, while Mr. Miller will have general charge of the investigation.

The Bureau of Forestry bespeaks the hearty coöperation of the people of Nebraska in this work, and will greatly appreciate any favors shown the members of the party that will in any way assist them in the prosecution of this study.



HON. JAMES H. ECKELS,

A LEADING FINANCIER AND ONE OF THE STRONGEST ADVOCATES OF NATIONAL IRRIGATION.

ONE of the first of our public men to take an active interest in the reclamation of the arid lands of the West was Hon. James Herron Eckels. As treasurer of the National Irrigation Association, and in many other ways, he has assisted this great cause. Few men of his age have been so long in positions of great responsibility as Mr. Eckels. As a public servant and as a business man he has won general esteem and confidence. He was born in Princeton, Ill., November 22, 1858. He was educated in city public and high schools, graduating in 1876. He graduated from Albany, N. Y., Law School in 1880, practiced law at Ottawa, Ill., from 1881-'93, and was appointed, April 3, 1893, Comptroller of Currency. He is a Democrat, and has made many speeches on the currency question, becoming prominent as a gold-standard advocate. In 1896 he affiliated with the National (gold-standard) Democrats. He remained in office until the end of 1897, becoming, January 1, 1898, president of the Commercial National Bank of Chicago.



OLD EPHRAIM.

WILDERNESS RESERVES.*

BY

PRESIDENT ROOSEVELT.

PART II.

A COUPLE of days after leaving Cottonwood Creek, where we had spent several days, we camped at the Yellowstone Cañon below Tower Falls. Here we saw a second band of mountain sheep, numbering only eight—none of them old rams. We were camped on the west side of the cañon; the sheep had their abode on the opposite side, where they had spent the winter. It has recently been customary among some authorities, especially the English hunters and naturalists who have written of the Asiatic sheep, to speak as if sheep were naturally creatures of the plains rather than mountain climbers. I know nothing of old world sheep, but the Rocky Mountain bighorn is to the full as characteristic a mountain animal, in every sense of the word, as the chamois, and, I think, as the ibex. These sheep were well known to the road-builders, who had spent the winter in the locality. They told me they never went back on the plains, but throughout the winter had spent their days and nights on the top of the cliff and along its face. This cliff was an alternation of sheer precipices and very steep inclines. When coated with ice it would be difficult to imagine an uglier bit of climbing, but throughout the winter, and even in the wildest storms, the sheep had habitually gone down it to drink at the water below. When we first saw them they were lying sunning themselves on the edge of the cañon, where the rolling grassy country behind it broke off into the sheer descent. It was mid-afternoon and they were under some pines. After a while they got up and began to graze, and soon hopped unconcernedly down the side of the cliff until they were half way to the bottom. They then grazed along the sides, and spent some time licking at a place where

there was evidently a mineral deposit. Before dark they all lay down again on a steeply inclined jutting spur midway between the top and the bottom of the cañon.

Next morning I thought I would like to see them close up, so I walked down three or four miles below where the cañon ended, crossed the stream, and came up the other side until I got on what was literally the stamping ground of the sheep. Their tracks showed that they had spent their time for many weeks, and probably for all the winter, within a very narrow radius. For perhaps a mile and a half, or two miles at the very outside, they had wandered to and fro on the summit of the cañon, making what was almost a well-beaten path; always very near and usually on the edge of the cliff, and hardly ever going more than a few yards back into the grassy plain-and-hill country. Their tracks and dung covered the ground. They had also evidently descended into the depths of the cañon wherever there was the slightest break or even lowering of the upper line of basalt cliffs. Although mountain sheep often browse in winter, I saw but few traces of browsing here; probably on the sheer cliff side they always got some grazing.

When I spied the band they were lying not far from the spot in which they had lain the day before, and in the same position on the brink of the cañon. They saw me and watched me with interest when I was two hundred yards off, but they let me go up within forty yards and sit down on a large stone to look at them without running off. Most of them were lying down, but a couple were feeding steadily throughout the time I watched them. Suddenly one took the alarm and dashed straight over the cliff,

the others all following at once. I ran after them to the edge in time to see the last yearling drop off the edge of the basalt cliff and stop short on the sheer slope below, while the stones dislodged by his hoofs rattled down the cañon. They all looked up at me with great interest and then strolled off to the edge of a jutting spur and lay down almost directly underneath me and some fifty yards off. That evening, on my return to camp, we watched the band make its way right down to the river bed, going over places where it did not seem possible a four-footed creature could pass. They halted to graze here and there, and down the worst places they went very fast with great bounds. It was a marvelous exhibition of climbing.

After we had finished this horseback trip we went on sleds and skis to the upper Geyser Basin and the Falls of the Yellowstone. Although it was the third week in April, the snow was still several feet deep, and only thoroughly trained snow horses could have taken the sleighs along, while around the Yellowstone Falls it was possible to move only on snowshoes. There was very

little life in those woods. We saw an occasional squirrel, rabbit, or marten, and in the open meadows around the hot waters there were geese and ducks, and now and then a coyote. Around camp Clark crows and Stellar's jays, and occasionally magpies, came to pick at the refuse, and, of course, they were accompanied by the whiskey jacks, with their usual astounding familiarity. At Norris Geyser Basin there was a perfect chorus of bird music from robins, purple finches, juncos, and mountain bluebirds. In the woods there were mountain chickadees and nuthatches of various kinds, together with an occasional woodpecker. In the northern country we had come across a very few blue grouse and ruffed grouse, both as tame as possible. We had seen a pigmy owl no larger than a robin sitting on top of a pine in broad daylight and uttering, at short intervals, a queer, un-owl-like cry.

The birds that interested us most were the solitaires, and especially the dippers or waterousels. We were fortunate enough to hear the solitaires sing, not only when perched on trees, but on



MOUNTAIN SHEEP AT CLOSE QUARTERS.



MAGPIES.

the wing, soaring over a great cañon. The dippers are, to my mind, well-nigh the most attractive of all our birds. They stay through the winter in the Yellowstone because the waters are in many places open. We heard them singing cheerfully, their ringing melody having a certain suggestion of the winter wren's. Usually they sang while perched on some rock on the edge or in the middle of the stream, but sometimes on the wing. In the open places the western meadow larks were also uttering their singular, beautiful songs. No bird escaped John Burroughs' eye; no bird note escaped his ear.

On the last day of my stay it was arranged that I should ride down from Mammoth Hot Springs to the town of Gardiner, just outside the park limits, and there make an address at the laying of the corner-stone of the arch by which the main road is to enter the park. Some three thousand people had gathered to attend the ceremonies. A little over a mile from Gardiner we came down out of the hills to the flat plain.

From the hills we could see the crowd gathered around the arch waiting for me to come. We put spurs to our horses and cantered rapidly toward the appointed place, and on the way we passed within forty yards of a score of black-tails, which merely moved to one side and looked at us, and within a hundred yards of half a dozen antelope. To any lover of nature it could not help being a delightful thing to see the wild and timid creatures of the wilderness rendered so tame, and their tameness in the immediate neighborhood of Gardiner, on the very edge of the park, spoke volumes for the patriotic good sense of the citizens of Montana. Major Pitcher informed me that both the Montana and Wyoming people were cooperating with him in zealous fashion to preserve the game and put a stop to poaching. For their attitude in this regard they deserve the cordial thanks of all Americans interested in these great popular playgrounds, where bits of old wilderness scenery and the old wilderness life are to be kept unspoiled for the benefit of



A SILHOUETTE OF BLACKTAIL.

our children's children. Eastern people, and especially eastern sportsmen, need to keep steadily in mind the fact that the westerners who live in the neighborhood of the forest preserves are the men who, in the last resort, will determine whether or not these preserves are to be permanent. They can not in the long run be kept as forest and game reservations unless the settlers round about believe in them and heartily support them, and the rights of these settlers must be carefully safeguarded, and they must be shown that the movement is really in their interest. The eastern sportsman who fails to recognize these facts can do little but harm by advocacy of forest reserves.

It was in the interior of the park, at the hotels beside the lake, the falls, and the various geyser basins that we would have seen the bears had the season been late enough, but unfortunately the bears were still for the most part hibernating. We saw two or three tracks, and found one place where a bear had been feeding on a dead elk, but the animals themselves had not yet begun to come about the hotels. Nor were the hotels open. No visitors had previously entered the park in the winter or early spring, the scouts and other employes being the only ones who occasionally traversed it. I was sorry not to see the bears, for the effect of protection upon bear life in the Yellowstone has been one of the phenomena of natural history. Not only have they grown to realize that they are safe, but, being natural scavengers and foul-feeders, they have come to recognize the garbage heaps of the hotels as their special sources of food supply. Throughout the summer months they come to all the hotels in numbers, usually appearing in the late afternoon or evening, and they have become as indifferent to the presence of men as the deer themselves—some of them very much more indifferent. They have now taken their place among the recognized sights of the park, and the tourists are nearly as much interested in them as in the geysers.

It was amusing to read the proclamations addressed to the tourists by the park management, in which they were

solemnly warned that the bears were really wild animals, and that they must on no account be either fed or teased. It is curious to think that the descendants of the great grizzlies, which were the dread of the early explorers and hunters, should now be semi-domesticated creatures, boldly hanging around crowded hotels for the sake of what they can pick up, and quite harmless so long as any reasonable precaution is exercised. They are much safer, for instance, than any ordinary bull or stallion, or even ram, and in fact there is no danger from them at all unless they are encouraged to grow too familiar or are in some way molested. Of course among the thousands of tourists there is a percentage of thoughtless and foolish people, and when such people go out in the afternoon to look at the bears feeding they occasionally bring themselves into jeopardy by some senseless act. The black bears and the cubs of the bigger bears can readily be driven up trees, and some of the tourists occasionally do this. Most of the animals never think of resenting it; but now and then one is run across which has its feelings ruffled by the performance. In the summer of 1902 the result proved disastrous to a too inquisitive tourist. He was traveling with his wife, and at one of the hotels they went out toward the garbage pile to see the bears feeding. The only bear in sight was a large she, which, as it turned out, was in a bad temper because another party of tourists a few minutes before had been chasing her cubs up a tree. The man left his wife and walked toward the bear to see how close he could get. When he was some distance off she charged him, whereupon he bolted back towards his wife. The bear overtook him, knocked him down and bit him severely. But the man's wife, without hesitation, attacked the bear with that thoroughly feminine weapon, an umbrella, and frightened her off. The man spent several weeks in the park hospital before he recovered. Perhaps the following telegram sent by the manager of the Lake Hotel to Major Pitcher illustrates with sufficient clearness the mutual relations of the bears, the tourists, and the guardians of the



BLACK BEARS AT HOTEL GARBAGE HEAP.

public weal in the park. The original was sent me by Major Pitcher. It runs:

"LAKE, 7-27-'03.

"Major PITCHER, *Yellowstone*:

"As many as seventeen bears in an evening appear on my garbage dump. Tonight eight or ten. Campers and people not of my hotel throw things at them to make them run away. I can not, unless there personally, control this. Do you think you could detail a trooper to be there every evening from say six o'clock until dark, and make people re-

kitchen. One completely terrorized a Chinese cook. It would drive him off and then feast upon whatever was left behind. When a big bear begins to act in this way or to show surliness it is sometimes necessary to shoot it. Other bears are tamed until they will feed out of the hand, and will come at once if called. Not only have some of the soldiers and scouts tamed bears in this fashion, but occasionally a chambermaid or waiter girl at one of the hotels has thus developed a bear as a pet.



CHAMBERMAID AND BEAR.

main behind danger line laid out by Warden Jones? Otherwise I fear some accident. The arrest of one or two of these campers might help. My own guests do pretty well as they are told.

JAMES BARTON KEY."

"9 a. m."

Major Pitcher issued the order as requested.

At times the bears get so bold that they take to making inroads on the

The accompanying photographs not only show bears very close up, with men standing by within a few yards of them, but they also show one bear being fed from the piazza by a cook, and another standing beside a particular friend, a chambermaid in one of the hotels. In these photographs it will be seen that some are grizzlies and some black bears.

This whole episode of bear life in the Yellowstone is so extraordinary that it will be well worth while for any man



COOK AND BEAR.

who has the right powers and enough time to make a complete study of the life and history of the Yellowstone bears. Indeed, nothing better could be done by some of our outdoor faunal naturalists than to spend at least a year in the Yellowstone, and to study the life habits of all the wild creatures therein. A man able to do this and to write down accurately and interestingly what he has seen would make a contribution of permanent value to our nature literature.

In May, after leaving the Yellowstone, I visited the Grand Cañon of the Colorado and spent three days camping in the Yosemite Park with John Muir. It is hard to make comparisons among different kinds of scenery, all of them very grand and very beautiful; yet personally to me the Grand Cañon of the Colorado, strange and desolate, terrible and awful in its sublimity, stands alone and unequaled. I very earnestly wish that Congress would make it a national park, and I am sure that such course would meet the approbation of the people of Arizona. As to

the Yosemite Valley, if the people of California desire it, as many of them certainly do, it also should be taken by the national government to be kept as a national park, just as the surrounding country, including some of the groves of giant trees, is now kept.

John Muir and I, with two packers and three pack mules, spent a delightful three days in the Yosemite. The first night was clear, and we lay in the open on beds of soft fir boughs among the giant sequoias. It was like lying in a great and solemn cathedral, far vaster and more beautiful than any built by the hand of man. Just at nightfall I heard, among other birds, thrushes which, I think, were Rocky Mountain hermits—the appropriate choir for such a place of worship. Next day we went by trail through the woods, seeing some deer, which were not wild as well as mountain quail and blue grouse. In the afternoon we struck snow, and had considerable difficulty in breaking our own trails. A snow storm came on toward evening, but we kept warm and comfortable in a grove

of the splendid silver firs—rightly named magnificent—near the brink of the wonderful Yosemite Valley. Next day we clambered down into it and at night-fall camped in its bottom, facing its giant cliffs over which the waterfalls thundered.

Surely our people do not understand even yet the rich heritage that is theirs.

There can be nothing in the world more beautiful than the Yosemite, its groves of giant sequoias and redwoods, the Cañon of the Colorado, the Cañon of the Yellowstone, the three Tetons; and the representatives of the people should see to it that they are preserved for the people forever, with their majestic beauty all unmarred.

FOREST TREE SEED COLLECTING IN NEW MEXICO.

DESCRIPTION OF THE METHODS FOLLOWED IN
GATHERING SEED FOR USE IN PLANTING ON
THE NEBRASKA SAND HILL FOREST RESERVES.

BY

WILLIAM H. MAST,

BUREAU OF FORESTRY.

I ARRIVED at Glorieta, New Mexico, September 4, 1903. My object in going to the region was to investigate the seed crop, find suitable places for collecting, and to collect forest-tree seeds, principally western yellow pine,

A couple of days' riding was sufficient to show me that red cedar (*Juniperus virginiana*), one-seed juniper (*Juniperus monosperma*), and piñon pine (*Pinus edulis*) are confined to the lower parts of the mountains, while the western yellow pine (*Pinus ponderosa*), red fir (*Pseudotsuga taxifolia*), and white fir (*Abies concolor*) occur at higher elevations, and the limber pine (*Pinus flexilis*) and blue spruce (*Picea parryana*) at still higher elevations near the timber line.

The altitude of Glorieta is nearly 7,500 feet. Immediately to the south a large mesa rises about 500 feet above the town. This mesa is covered with piñon pine, interspersed with western yellow pine. The Pecos River valley at the foot of the mesa has a scattered growth of piñon and red cedar, nearly all of which is low and shrubby. Only a small per cent of these trees are more than fifteen feet high and many do not

reach ten feet. The soil is a reddish adobe, containing small boulders; also deposits of sandstone and limestone.

At this time special attention was given to piñon pine, as its cones ripen earlier than those of most of the other species. Diligent searching revealed that the crop was very light in that locality. The trees, which were bearing, had an extremely poor quality of cones. They were small, with only two or three seeds developed, and often these were infertile. Some cones had been infested and destroyed by insects. The pine birds were beginning to take the better cones. The white fir, red fir, and western yellow pine cones were not ripe, so it was thought best to go to another locality. Accordingly I went to Santa Fé.

The low hills for several miles in every direction from Santa Fé are covered with red cedar and one-seed juniper, with some piñon pine, while the higher mountain slopes have red fir and western yellow pine, with a great deal of white fir in the canyons and stream beds. It was found that one-seeded juniper seed could be obtained without going far from Santa Fé, although only a small per cent of the trees were bear-

ing. Several days were spent collecting this species.

Upon returning to Glorieta some days later, the collecting of piñon pine seed was begun. This was followed by the collecting of red fir, white fir, limber pine, blue spruce, and western yellow pine. During this time more one-seed juniper was obtained near Santa Fé, and also small amounts of red cedar were gathered near Glorieta.

METHODS OF COLLECTING.

One-seed juniper (*Juniperus monosperma*).—Almost the entire amount of seed of this species collected was obtained within three miles of the city of Santa Fé. The trees were of low, brush-like form, from four to eight feet high. A piece of canvas was spread beneath the tree, and cards were used to remove the berries from the branches. The cards were of simple construction, each consisting of a soft wood board eight inches long by four inches wide, with one end shaped into a handle and a row of eight-penny nails driven through the board at the other end. The nails were arranged at distances too small to allow berries to pass between them, though space enough for twigs to pass through.

The berries were emptied from the canvas into sacks, and later worked over to separate the refuse material from them. For this purpose a sieve having quarter-inch mesh allowed most of the berries to go through, and those which still clung to twigs could be rubbed through. This sieve removed the twigs, and by running the berries over a sieve of ordinary window screen the leaves and dust passed through, leaving the berries clean. The same method was employed in collecting and cleaning red-cedar seed.

Piñon pine (*Pinus edulis*). It was difficult to get piñon pine cones, for the pine birds had visited nearly all the trees and taken the cones which contained good seed. The birds seemed to be able to discern accurately which ones contained good seed. Under some trees the ground was thickly strewn with cones from which the birds had removed the seed.

In collecting piñon cones the men climbed the trees, and either pulled the cones off or knocked them off with sticks and afterward gathered them into sacks. The cones were taken to a small log building, where they could be spread on shelves and dried. The shelves were three feet and five and one-half feet above the floor, and the heat was applied from a large fireplace in the corner of the room. Four or five days with the room at a temperature of 100 to 125 degrees were required to open the cones. Then only the large cones opened, the small inferior ones still remaining closed. I consider this method an unsatisfactory way of removing the seed, as there is danger of getting the temperature so high at times that the seed on the upper shelves may be slightly roasted, or at least its vitality may be impaired.

Red fir (*Pseudotsuga taxifolia*).—The red fir cones were plentiful. Trees from 25 to 50 feet high, with branches down within a few feet of the ground, were found more convenient to collect from than larger trees. The cones were thickest near the tips of the branches and in the tops of the trees. After climbing the tree a hooked stick was used to good advantage in getting hold of the tips of branches to draw them in where the cones could be pulled off with the hands. A stick about four feet long with an iron hook fastened to it was found quite useful.

With the proper curve in the lower hook it may be used advantageously by pushing it along the side of a branch to catch and break off cones from branches that are too rigid to be bent toward the center of the tree and brought within reach of the hands. Usually there are a great many cones about the leader at the top of the tree, where it is too small to bear the weight of the picker, and there is danger of breaking it if it is bent down far enough to be reached. The lower hook of the tool enables the picker to strip the leader upward without breaking it. It is best to start at the top of the tree and work down, for in this way the cones which come from the upper branches and lodge on their way down are shaken off when the lower branches are being picked; thus

no time is lost in dislodging cones that have been caught in falling.

A portion of the red fir cones were dried and opened by the same method as employed for the piñon pine. However, opening cones by artificial heat is not satisfactory. Where there is bright sunny weather and the cones have reached the proper stage of maturity before being gathered, they will open within a few days by sunning. If they can be placed on the south side of a building where they will receive some reflected heat they will open still more rapidly. I believe the change of temperature due to the cooling at night to be beneficial.

White fir (Abies concolor).—The white fir trees were found in the side canyons and sometimes in the bottom of the main canyons. The cones in nearly all cases, especially on the young trees, are found in thick clusters at the tops of the trees. As it was dangerous for the picker to climb so near the top of the tree, he was provided with a steel hook on a long handle to cut or break off the cones.

The cones were taken in sacks to the drying-room, where they were dried by artificial heat and the seed removed by passing the cones over a sieve. A sieve with a quarter-inch square mesh allowed the seed to go through, but kept back the cone-scales. By use of a sieve of ordinary window screen and by a small amount of winnowing, the dust and resin were taken out.

Limber pine (Pinus flexilis).—Only a small amount of limber pine seed was obtained. To secure cones it was necessary to climb the seed tree and break them off with the hands or knock them off with a stick. The seed of this species was also removed by artificial heat. However, only a small amount was required, as the cones were over-ripe when collected. In fact, some of the seed had already fallen from them before they reached the drying-room. Limber pine cones are usually ripe enough to be collected early in September, and the seed is very easily expelled when they commence to open. The trees of this species are not plentiful in the region of Glorieta, and those found were bearing only a partial crop this year.

Blue spruce (Picea parryana).—In this region the blue spruce does not appear below an altitude of 9,000 feet. Like the limber pine, it also ripens early.

As it was impossible for me to secure cones at the time of ripening, a man was sent into the woods in the latter part of October to get cones which had been cut down and burrowed by the squirrels. Several of the squirrels' storehouses were found, and $7\frac{1}{2}$ bushels of cones taken from them. These cones had been cut down at the proper time and covered with moist leaves, so that they were still closed and in excellent condition. A few days' drying in the sun was sufficient to open them. The seed was jarred out by flailing, and then run through a fanning mill to clean it.

Western yellow pine (Pinus ponderosa).—The collecting of the western yellow pine seed was deferred till there could be no doubt about the cones being entirely ripe. A few cones were collected between October 1 and October 10, but collecting was properly commenced October 12, when half a dozen men began work. A few days later more than twenty-five laborers were collecting. Nearly all the cones were collected between October 12 and 26. Of the 1,120 bushels of cones collected, over 800 bushels came from trees growing on land held by private individuals; the remainder were gathered on the Pecos River Forest Reserve. The owners of land felled trees, picked the cones from them, and later cut the trees into ties and cord-wood. The men were paid 20 cents per bushel for cones delivered at the drying grounds.

The cones were fully ripe, and as there were far too many of them to attempt drying by artificial heat, they were spread on the bare rocks and on the ground to open. On account of the lack of space on the rocks in the vicinity to allow the cones to be spread out thinly, a large drying floor was prepared on an old threshing floor. This was a level dirt floor, about 40 by 50 feet, which had not been used for several years. The surface was cleaned of weeds and loose dirt, then well soaked with water, and a herd of goats driven back and forth over it till it was dry and hard.

Their sharp hoofs served well to mix the mud and pack it, so that when it was dry it presented a hard and comparatively smooth surface, less liable to break open with large cracks than if the mud had been firmed with a tamper, then allowed to dry in the direct sun.

Still the lack of space made it necessary to have the cones three or four layers deep over a large part of the drying grounds. The sun could have little effect on any except the surface layer. When this layer was open it was flailed to jar out the seed. When a small area was raked bare of cones and the seed taken up, closed cones were drawn over it, leaving another bare space for the removal of seed. In this way the whole pile was worked over, and when finished the seed had been swept up from all parts of the area and the closed cones brought to the surface ready for sunning. Four to seven days' exposure in the direct sun was necessary to open the cones sufficiently to get the seed out. Each pile was worked from three to five times. This amount of handling removed nearly all the seed. There was, however, a small quantity scattered around the edge of the drying grounds, which could not be recovered; also a small amount was taken by the pine birds, which came in flocks to the cone piles.

In sweeping up the seed from the ground and rocks, a great deal of dust, sand, and pitch was taken up with it. Access to a fanning mill made it possible to separate nearly all the foreign material from the seed. The wings were not taken off till after the seed had reached Halsey, Nebraska. To separate the wings from the seed, a small quantity of seed in a sack was beaten against a stone or block of wood till the wings were broken off, and then winnowed. By another method a quantity of seed in a sack was laid on the floor and rubbed with the foot till the wings were ground off, then winnowed. After putting the seed through either of these processes, it was perfectly clean. A loss of twelve per cent was sustained in the last cleaning of the seed.

Laborers hired for collecting seed were Mexicans. They were paid \$1 or \$1.25 per day without board. One man received \$1.50 per day. This man was a first-class worker and was put in charge of other laborers a portion of the time, and also acted as my interpreter. Day labor was not used extensively in the collection of western yellow-pine cones, as it was found that a large number of pickers could be handled with much less trouble and more satisfaction when paid by the bushel upon the delivery of the cones. This plan saved a large expense for transportation which would have been incurred if the cones had been picked by day laborers, for some of them were hauled from points six to ten miles distant from the drying grounds.

Some men who could not have been induced to work by the day and who would have been worth very little if hired in this way were persuaded to commence collecting by the bushel. Some of these men brought in a great many cones, for by this arrangement all members of the family were allowed to work. Some men who had private holdings and usually made railroad ties for a living cut down trees on their own land and gathered the cones.

Mexican labor is not generally very efficient. However, it is cheap and is about all that can be had in that region. To secure satisfactory service it is necessary to be with the men and oversee the work.

The following table shows the amount of seed collected and the cost per pound of collecting each species:

Species.	Total pounds collected.	Cost per pound.
One-seed cedar	203	\$.235
Red cedar.....	13	.355
Blue spruce.....	9	.90
White fir.....	82	.355
Red fir.....	87	.73
Piñon pine.....	31	.71
Limber pine.....	4.7	1.47
Western yellow pine.....	1736	.23
	2165.7	

FOREST THINNING AND ITS RESULTS.

BY

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FIELD ASSISTANT, BUREAU OF FORESTRY.

PART II.—THE RESULT OF THINNING.

THE Forest Academy at Tharandt has one of the oldest and most systematically carried out thinning experiments in Germany.* The stand is Scotch pine and belongs to the first-quality class. This tract was taken under observation in 1862, and since 1863 has received systematic thinnings in five-year periods. Three grades have been used—A, B, and C. The A grade only removes class Vb, and may therefore hardly be called a thinning at all; but in B, classes Vb, Va, and IVb are taken, and in C, besides these also class IVa and part of III. The table on the following page shows detailed results of this experiment.

The most noticeable fact in this table is the comparative lack of result in the B thinning. On the other hand, the C shows a most pronounced increase in quality and general character over the unthinned area. With two hundred trees less to the acre, the volume is the same as that in the first plot, the average tree being more than an inch greater in diameter and ten feet higher. This means that the timber is of a higher quality and will bring a much better price. There has also been an intermediate yield of 1,036 cubic feet of sound wood against 421 cubic feet of nearly worthless dead wood in the unthinned acre. It is also clear that the damage from wind, insects, etc., decreases with the degree of thinning, a direct answer to those who claim that thinning endangers the forest from windfall.

An experiment quite similar to that at Tharandt was instituted at the Austrian station in Mariabrunn.† The first thinnings were begun in 1882, and have

been carried on in five-year periods to the present. The species is Austrian black pine (*Pinus laricio austriaca*), and the thinnings are designated I, II, and III, corresponding very closely to the above given A, B, and C. A light increment cutting is also included, designated by IV. This is out of the pale of thinning, but incidentally shows a poor result compared with III. The accompanying plate, taken from a photograph, shows the diameter growth of the average tree in each grade. The increased growth of III over I is very noticeable. On the other hand, II also shows very well.

As the result of a very greatly increased interest in this subject, which commenced about 1885, Prof. Buehler, then head of the Swiss Forest Experiment Station at Zurich,* began an elaborate experiment in thinning where four degrees were tested. These were designated by A, B, C, and D, corresponding to the table given in the preceding article. A total number of 254 experimental plots, averaging about an acre each, were laid out in spruce, silver fir, and beech, and all trials were rigorously carried out by the same system. Since that time other areas have been taken on, but, for the sake of brevity, only the outcome of a series of spruce thinnings in the Sihlwald will be discussed. The table on page 315 is a summary of the main results.

In this experiment the degrees of thinning differ slightly from those given in the preceding table. The A thinning approaches the B thinning at Tharandt, the Swiss B thinning lies between the German B and C, and the Swiss C slightly exceeds the C at Tharandt.

* Kunze in Tharandter Forstl. Jahrbuch, vol. 45, pp. 1-44; vol. 52, p. 157.

† Öster. Forst. & Jagdt. Zeitung, May, 1903.

* Mitt. d. Schw. Centralanstalt f. d. Forstl. Versuchswesen, vol. 3, p. 7, and vol. vii, p. 1.

TABLE 10. — *Continued from Table 9.*

Year	Age,	A.				B.				C.			
		No. per acre	Average diameter, inches	Average height, feet	Vol. per acre, cu. ft.	No. per acre	Average diameter, inches	Average height, feet	Vol. per acre, cu. ft.	No. per acre	Average diameter, inches	Average height, feet	Vol. per acre, cu. ft.
1863-69 1869	21	Total standing Woodfull, etc. Thinning *	2.5	23	1,419	3,294 330	..... ..... .....	..... ..... .....	..... ..... .....	3,292 760	..... ..... .....	..... ..... .....	..... ..... 29.6
1870-76 1876	22	Total standing Woodfull, etc. Thinning *	2.5	23	1,461.8 37.2 3.1	3,294 423	..... ..... .....	..... ..... .....	..... ..... .....	3,292 334	..... ..... .....	..... ..... .....	..... ..... 1.134.0
1877-83 1878-79	23	Total standing Woodfull, etc. Thinning *	3.3	25	1,553.1 9.1 66.6	3,294 39	..... ..... .....	..... ..... .....	..... ..... .....	3,292 38	...............	...............	...............
1880-86 1881-82	24	Total standing Woodfull, etc. Thinning *	4.0	27	1,640.7 1.9 35.9	3,294 131	..... ..... .....	..... ..... .....	..... ..... .....	3,292 129	...............	...............	...............
1883-89 1884-89	25	Total standing Woodfull, etc. Thinning *	4.7	27	1,714.1 2.9 57.7	3,292 91	..... ..... .....	..... ..... .....	..... ..... .....	3,292 795	...............	...............	...............
1890-96 1891-91	26	Total standing Woodfull, etc. Thinning *	5.6	14	1,839.0 5.5 115.1	2,835 135	..... ..... .....	..... ..... .....	..... ..... .....	6,295 113	...............	...............	...............
1895-100 1900	27	Total standing Woodfull, etc. Thinning *	6.3	20	1,709.1 27.4 157.6	3,693 104	..... ..... .....	..... ..... .....	..... ..... .....	4,692 115	...............	...............	...............
1901	28	Total standing	7.8	22	1,219.8	433	7.6	26	3,534.6	334	7.4	27	3,244.2
		Total volume of thin logs, etc.			421.4				.....				.....
		Total merchantable volume grown			3,749.5	.....			4,326.5				4,786.5
		Woodfull, etc.			151.1				276.5				241.7

* 100-30 yearly dead wood removed.
 1.8 and 6.6 inches and over in diameter at breast end.

THINNINGS IN SPRUCE (*Picea excelsa*).

	A.			B.			C.			D.		
	1889.	1894.	1899.	1889.	1894.	1899.	1889.	1894.	1899.	1889.	1894.	1899.
Age.....	28	33	38	28	33	38	28	33	38	28	33	38
Number removed per acre....	.....	51	132	232	121	144	486	44	176	852	20	141
Number after thinning per acre....	1,447	1,275	1,143	1,205	1,065	921	934	881	704	677	638	497
Average diameter after thinning.....in.	5.4	5.9	6.1	5.9	6.3	6.9	6.4	6.8	7.5	6.4	7.1	8.0
Average height.....ft.	45.7	51.8	56.7	47.7	55.0	62.1	48.8	57.4	63.9	50.3	55.7	63.6
Volume removed per acre.....cu. ft. *	.....	78.6	421.6	337.3	271.5	417.3	934.7	126.1	806.1	2,116.6	90.0	831.8
Volume after thinning per acre.....cu. ft. *	5,402.1	5,716.6	6,531.3	5,712.6	6,529.6	7,595.1	5,241.7	6,390.6	6,989.7	4,074.5	4,963.2	5,599.5
Total volume removed in three thinnings.....	.....	.....	500.2	.....	.....	1,026.1	.....	.....	1,930.8	.....	.....	3,038.4
Total volume growth.....	.....	.....	7,031.5	.....	.....	8,621.3	.....	.....	8,920.5	.....	.....	8,637.9

* To 2½ inches at small end.

At first glance the B thinning seems to give the greatest volume, but the number of trees is not much less than that in A, and therefore the quality and price is not radically bettered. On the other hand, C has 400 trees to the acre less than A, with a greater actual volume of 400 cubic feet standing, exclusive of 1,400 cubic feet more yield in the thinnings. It is also evident that the D thinning is too severe.

From a great mass of facts compiled in this report and covering about 150 experiments in all ages, certain important facts may be summarized.

The volume of merchantable wood left after thinning has never fallen below the volume left after the previous thinning.

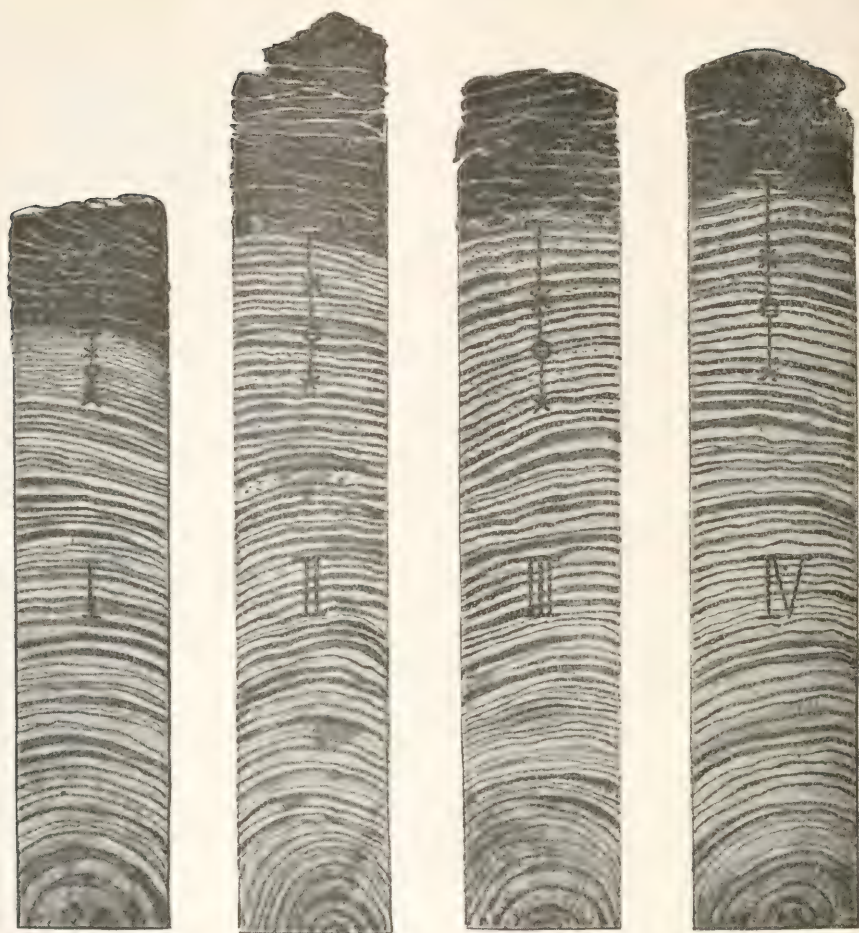
The cleanness of bole decreases with the degree of thinning. It is relatively best in B and C.

The greatest production of merchantable timber is obtained in the grades B and C. The best condition probably lies between B and C, with an inclination toward C. (This probably corresponds with the C thinning at Tharandt.) When expressed in money value, the C grade shows an even better result.

The current yearly height growth is better in C than any other grade of thinning. The lightly thinned area A shows the poorest height growth, and the increase in B is not remarkable. This point is clearly shown in every instance and is very interesting. It has been generally held that close-grown trees are very much stimulated in height growth, but these figures prove that a reasonable amount of room not only increases the diameter, but also the height. In this a most important argument has been adduced in favor of thinnings. When grown too openly, however, the relative height growth falls off, as shown in the D thinning.

The greater diameter growth in D takes place only in the lower part of the stem. The bole is more tapering and has less volume than in B or C. The best proportion between height and diameter is shown in C, with B closely following it.

In young and middle-aged spruce stands the thinning should lie between B and C, inclining more toward C.



THREE GRADES OF THINNING AND A LIGHT INCREMENT CUTTING (IV). SECTIONS FROM THE AVERAGE TREE IN EACH SAMPLE PLOT.



From the fiftieth or sixtieth year on the thinning should be about the C grade.

At the beginning of the last third of the rotation, or about the seventy-fifth year, the trees should be so formed and in such relation to each other that no more real thinnings are necessary. From this time on all the increment should be in the final stand.

Stands which are in bad condition through lack of early thinning or other causes should be successively thinned to the C grade, as they recuperate best by this method.

In these experimental results no mention has been made of selection thinning. The only figures which deal with this subject known to the writer are those of Dr. Wimmenauer in Giessen. In 1894-'95 he began the comparison with ordinary B and C thinnings with the Borggreve method and *éclaircie par le haut* or ordinary selection thinning. Borggreve's method takes out that part of the dominant stand which is merchantable in the expectation of developing dominant trees from the suppressed members of the forest.

After the first five-year period, in

1897-'98, the proportionate yield of each method stood as follows:

C thinning, 100 per cent.

Borggreve, 90 per cent.

Selection thinning, 82 per cent.

At the second thinning, in 1902-'03, the result had changed to:

C thinning, 100 per cent.

Borggreve, 65 per cent.

Selection thinning, 82 per cent.

Although this experiment has not progressed far enough for definite results, it seems already to show the impracticability of the Borggreve method. On the other hand, the position of selection thinning is better than the proportion would seem to evince. The stand was heavily cut into and has not had time to recuperate. The general appearance of the trees is better than by any method and the total increment is largely in the trees chosen for the final stand. The author expects that this method will finally give the best results of any system.

CONCLUSION—FOREST THINNING IN AMERICA.

The European results here summarized would have no interest or value in this country were it not for the useful experience which may be adapted to American conditions. German forestry is intensely conservative and has developed very slowly. This is especially true in regard to thinnings, as it may be safely asserted that four-fifths of the forest land today is not thinned beyond the A or B grade of the Tharandt experiment. Hartig, who practically founded the art of forestry at the end of the 18th century, laid it down as an axiom that no dominant trees should be cut and the cover never broken in thinning. In spite of modern teaching, his influence seems to still live, and the average thinning yields but a comparatively small amount of low-grade wood. Such a method may pay well enough in a country where wood is so dear as in Germany, but in America this timber could be removed only at a loss, and therefore could not be touched at all. Hence it is of the greatest importance that a method of heavy thinning shows the best financial results in both the final

and intermediate yields. If a correct system gives large enough timber to make thinning pay, we can begin our experience with all the accumulated knowledge of Germany behind us and save ourselves time and trouble by commencing on the right track.

Of course, it is evident that it is only possible to practice thinning in a small part of the American forests. Throughout the great lumbering regions they are not to be considered at all, but there is a large area of country in the north-east where thinning should often pay if properly managed. In parts of New England, New York, Pennsylvania, Ohio, and Indiana there are numbers of woodlots and timber tracts which could be profitably improved by systematic thinning.

The tree classification is the most important and difficult preliminary to an effective system. The trees should be divided into enough classes to make several degrees of thinning quite distinct from each other, and at the same time the division should be so broad that there is no doubt of the class to which every tree in the stand belongs. The classification given in Part I is not difficult to apply after a little practice, but for American conditions the following plan seems more advisable:

Class I. Dominant. Trees which make the upper forest cover.

a. Withsymmetrically formed crowns.

b. With unevenly developed crowns.

Class II. Overtopped. Trees which have fallen in growth below the upper forest cover.

a. With crowns free to the light.

b. With crowns directly shaded, but still thrifty.

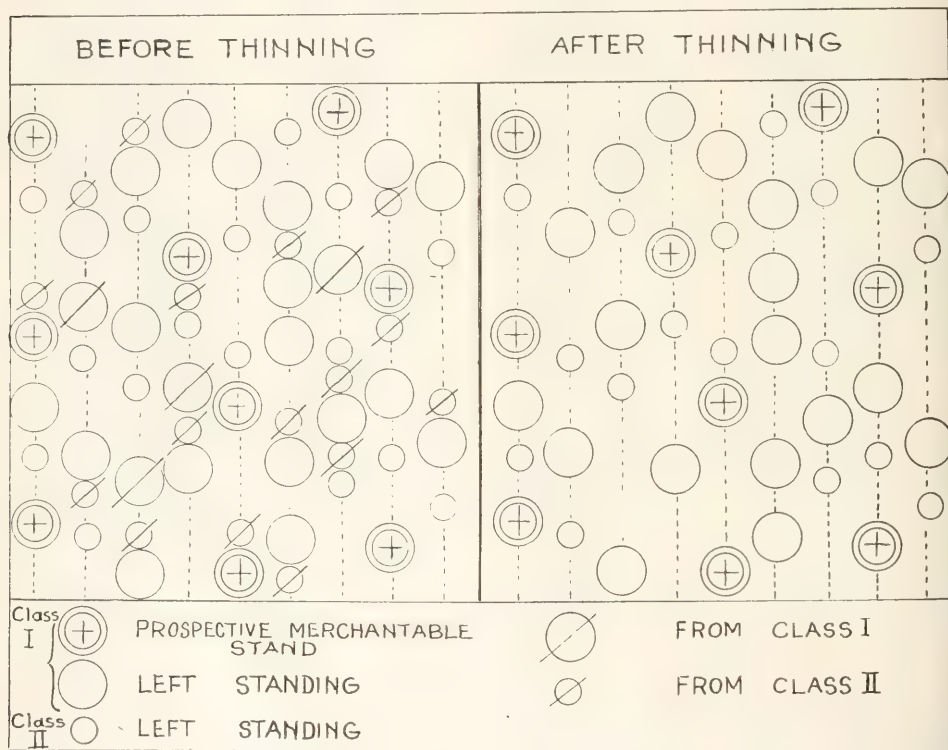
c. Dying or dead.

This grouping is less arbitrary than the other and follows nature more closely. Its simplicity will make it easy to apply to the conditions of the average woodlot. Trees belong to Classes I and II only in relation to their immediate neighbors. An individual which from its size belongs to Class II in one part of the forest may be in Class I where the general average is smaller.

As wood is cheap and labor dear, it follows that thinning will not pay until

the timber has reached some size. In the foregoing section it was shown that such woods do best when thinned to the C grade, which also yields a good amount of merchantable wood. The selection system, however, also shows well, and as a paying result is the first consideration for the average American thinning, it will be wise to combine the methods and cut the greatest amount of timber compatible with the best final yield.

there are probably many cases where woodlot owners are willing to make a reasonable outlay. In twenty-year-old growth or thereabouts, remove most of Class II and take out those specimens of Class I *b* and *a* which are noticeably crowding the better members of the same class. Cut all trees which have started a few years before the others and have grown up branchy or badly formed. If the mixture needs regulation, this is the time to attempt it.



THINNING IN 27-YEAR-OLD PLANTED WHITE PINE.

Every woodlot has different conditions, but there are a few general points which may be discussed in broad lines and which are applicable to all. True thinnings are only possible in stands of fairly thrifty growth which have a good cover. Ragged and sparse woods must be built up by improvement cuttings, which are not here considered.

A. Thinning a Sapling Stand.—There are not many places where it would pay to thin in young forests, but

The cover should not be broken more than temporarily.

B. Thinning in Pole Stands.—If thrifty forest has got well into the pole stage without a thinning, there will be considerable wood for removal. Select particularly thrifty, well-formed trees from Class I *a* and set them free to a reasonable extent on all sides by removing any class which presses them. Bring the remaining members of I *a* and *b* into a good relative position by

judicious thinning, and remove all of 11c, leaving 11a and b for a ground cover. These latter are too small to take out profitably, and yet, by allowing them to remain for cover, more of the paying sizes in 1a and b can be removed. The accompanying diagram represents a trifle more than four square rods of twenty-seven-year old white pine which has been thinned by this method. The selected trees are from 12 to 15 feet apart. It is expected that the final

stand will be recruited from these, but if anything happens to some of them other members left from Class I will take their places. A similar but less radical method can be applied to a pole thinning which has been thinned in the sapling stage.

Thinning has little effect after the period of most vigorous growth. If the stand has become mature without thinning it will probably be best to make a light increment cutting or successive cuttings for reproduction.

LITTLE COLORADO RIVER.

WITH ITS TRIBUTARIES MAY BE USED
TO RECLAIM ARIZONA ARID LANDS.

A FIELD party consisting of members of the U. S. Geological Survey, under the direction of Assistant Engineer James G. Camp, has made an investigation of the possibilities of irrigation on the Little Colorado River, in Arizona.

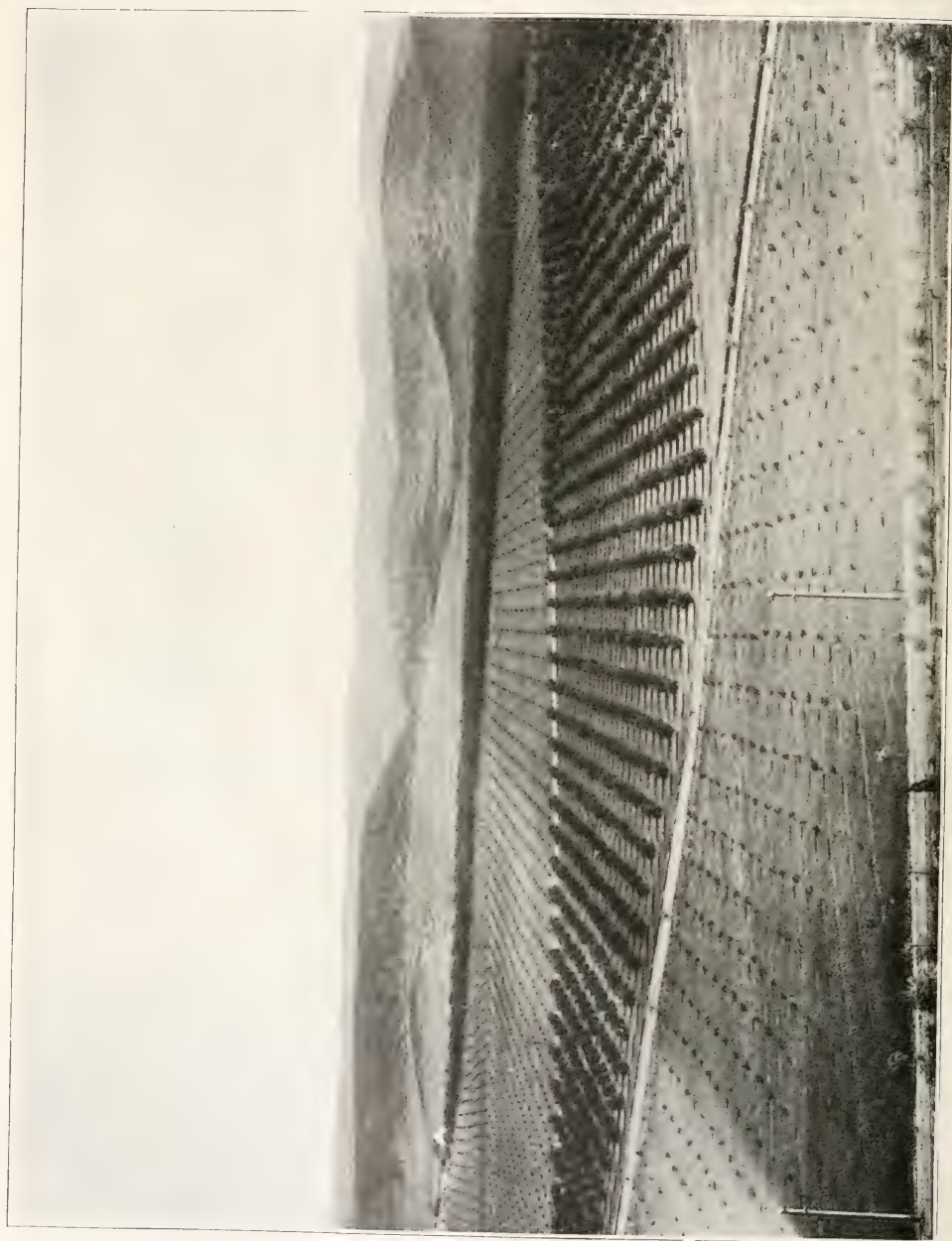
The Little Colorado River drains nearly 9,000 square miles in northeastern Arizona and 6,000 square miles of territory in northwestern New Mexico, making a total drainage area of 15,000 square miles tributary to the river above Winslow, Arizona. This drainage basin extends from the Mogollon Mountains

on the south to the Salahkai Mesa on the north, and eastward to the Continental Divide. There are two flood seasons—the spring flood, due to the melting of snow on the mountain slopes, and the fall flood from the late summer rains.

The surface of most of this area is either red or blue clay on the lower slopes and a solid sand or lava rock partially covered with sod. The latter covers 50 per cent of the mountain and foothill slopes. As no measurements of the flow of the Little Colorado nor its tributaries have been made during



WESTERN PLAIN COVERED WITH SAGE BRUSH, BEFORE IRRIGATION.



AFTER THE APPLICATION OF WATER.

the flood seasons, the amount of water available is entirely conjecture, but it is known to be very great at times and very small at others, being often entirely dry at places. From these conditions it is very evident that any reliable system of irrigation must depend on reservoirs, not only to hold the spring waters for midsummer use, but to carry the surplus of waters of a maximum year through a series of from three to five years to meet the conditions of drouth which sometimes prevail.

At present only a small area of land is irrigated along the Little Colorado River, there being small tracts of from 1,000 to 3,000 acres farmed by irrigation and scattered Mexican ranches consisting of only a few acres of garden and meadow. Approximately 16,000 acres are irrigated at present, but a large part of these lands lack water through July and August. This difficulty has been partly met by small reservoirs, but faulty construction and the resultant frequent breaking of dams make these reservoirs expensive and of but little real benefit.

In the valley of the Rio Puerco, the main tributary, are several fine bodies of land, but the fact that there are no reservoir sites above them renders them unavailable unless the underflow can be pumped onto them. Below the junction of the Rio Puerco and the Little Colorado is a valley from one to five miles wide, part of which is fertile, cultivable land, and below Winslow this

valley widens out to eight miles in width and has a fine sand loam soil.

Zuni River and Cottonwood Wash drain considerable areas, mostly "bad lands," but their flow can not be depended upon, much of the time becoming lost in the soil, and at all times carrying so much silt as to make the storage of their waters impracticable.

The winters are not severe and the summers are hot and dry. Originally this section was a fine grass country, supporting large herds of cattle, but excessive pasturing of sheep and several dry seasons nearly ruined it as a grazing country. Alfalfa is the principal crop, but sorghum, corn, barley, and wheat give fair yields. Gardens and sugar beets do well, and fruit trees grow well, although the late frosts are injurious. Owing to the mild winters the main crops will always be forage.

Several dam sites were found, canal lines run, and estimates of cost made after thorough investigations of all the features. A general summary of the report shows that a storage capacity for 428,440 acre feet can be obtained; that there are 161,000 acres of agricultural land so situated that it could be irrigated from this system; that under irrigation this land will produce profitable crops, and that there is a market for these products. To determine accurately how many acres could be irrigated and the cost of this irrigation it will be necessary to establish gaging stations to obtain the needed data on the water supply and to make tests for silt and evaporation.

FOREST PLANTING IN WESTERN KANSAS.

BY

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BUREAU OF FORESTRY.

FOREST planting along the eastern border of the Great Plains began years ago and has resulted in abundant success. Agriculture is pushing steadily westward, however, and where in 1873 the buffalo held almost unmolested sway,

a single county raised nearly 4,000,000 bushels of wheat in 1903. The cattleman succeeded the buffalo, and he in turn will be dispossessed until much of the "short-grass country" is under the plow. Given a soil having the great

depth and fertility of that in western Kansas, together with an average annual precipitation of nearly 20 inches, even though it be somewhat periodic, it is safe to predict that American ingenuity and perseverance will eventually conquer. The sod-house days of '87 are past, and there is now a healthy, steady growth. The present settler comes here with a knowledge of conditions and the determination to master them. Improved methods of cultivation and drouth-resisting crops are being tried. The cattleman has found that he can raise sorghum and Kaffir corn practically every season, and that it pays better to feed his stock during the winter than to let them "rough it through" in the old-fashioned way. In the creek and river valleys alfalfa is being grown without irrigation clear to the Colorado line, and with the alfalfa go the dairy cow and the cream can.

It is unnecessary to enter upon any discussion of the causes of the well-nigh total lack of trees on the Plains. Whatever may be the reasons for the absence of natural forests, experience has proved that to a considerable degree artificial ones may be made to take their place. The generally accepted ratio is that for the best agricultural conditions one-fourth of the country should be forested. There is little likelihood that half this amount will ever be attained in western Kansas; yet the planting that will be done as the state increases in age and wealth will be sufficient to greatly modify the landscape and supply many domestic purposes. In favored localities commercial returns may be expected; elsewhere the recompense to the planter will be in the form of increased comfort and convenience.

The most extensive early plantings were on the timber claims. They generally resulted in failure because of wrongly chosen species and neglect. The man who made a timber-culture filing did so to get a quarter section of land, not because he cared for trees or knew anything about them. If he could evade the law and prove up without any trees whatever, he was quite likely to think himself that much ahead. There were some well-planted and conscien-

tiously-cared-for claims; they speak for themselves today. The majority, however, came to little or nothing, and, after various modifications, the law was repealed in 1891.

The planter now plants because he wants trees and realizes their value; consequently he will be more careful in his choice and give more after attention than did his predecessors. A close examination of the country leaves little room for doubt concerning the success of forest planting in western Kansas if the species are intelligently selected and properly cared for. The attempt has been to make it conservative and practical rather than theoretical. It is written wholly from a non-irrigation standpoint, not because the writer does not believe in irrigation wherever possible, but because there is small prospect that large upland areas of the region will ever be irrigated. Since it is safe to say that the majority of the forest-tree planters will not irrigate, the species and methods suited to their needs are described. Those who are so fortunately situated as to have artificial water can get correspondingly better results with the same species, besides having others that can not be grown at all without irrigation.

WHERE TO PLANT.

In a naturally treeless region there is need for planting almost everywhere. Trees should be planted around houses, sheds, corrals, and garden patches for protection and ornament; planted in groves for posts, fuel, and the numberless uses which a stick of timber supplies; planted in parks and along streets because trees are a great factor in making a town "a good place to live in;" planted in school-house, church, and court-house yards, so that public buildings shall not suffer by comparison with private ones, and planted for commercial purposes wherever possible, since a good plantation will afford a steady income aside from much pleasure and convenience.

While general soil conditions vary little throughout western Kansas, there is abundant room for the selection of situations in which to plant. Trees like other forms of vegetation, respond

quickly to good soil and moisture. The species which will grow on the uplands may be depended upon to do as well or better in the valleys, but the reverse case is far from being true. Hundreds of failures in upland planting in Kansas and Nebraska have resulted simply because the cottonwood, willow, soft maple, and box elder of the lowlands were expected to thrive in the drier situations. Some trees, the hackberry and elm, for instance, which grow naturally along water-courses, do well under cultivation on the upland, while others found in company with the hardy species fail entirely when the change is attempted.

The experimental stage has passed, and now the planter can use species whose worth has been proven, whatever his locality. There are local depressions on the upland which catch considerable run-off, and so are suited to species which need more than the normal precipitation of the region. In such a place, on the high upland of Wallace county the writer was surprised one day to find a row of black walnuts, neglected in the sod, yet looking well and bearing nuts. It was the result of the haphazard planting of some settler who had long since departed and of whose sod house only a heap of dirt remained. The explanation was simple. A cattle trail and wheel tracks served to conduct the rainfall down the gentle grade to a shallow basin, and the instant the point was passed where water collected occasionally, only a few small stumps were left to tell the tale of drouth and disaster. Nearly every quarter section has some spot of an acre or more of this character which could be profitably utilized for tree planting. By putting the moisture-requiring species in the favored situations and the drouth-resisting ones elsewhere, the planter's range of choice is extended with most beneficial results.

HOW TO PLANT.

For plantations of the common broad-leaf species, one-year-old seedlings are best to use, since they are easier handled and much cheaper than older trees. They ordinarily run from one to two feet high, and have no branches to speak

of, so that little pruning is required. If the ground has been well prepared and is moist, the setting can be done very rapidly. A man and a boy work well together. The boy carries the trees and hands them to the man as wanted. The latter sets his spade full length in the ground, throws the handle forward, sticks a seedling in behind the blade, removes the spade, steps firmly with both feet on the ground around the tree, and the operation is complete, the whole thing not taking more than half a minute. A number of seedlings can be carried in a bucket partially filled with water or in a basket, with a wet cloth covering the roots, the remainder of the stock being left heeled in until needed. Another rapid method is to plow a furrow where the row of trees is wanted, lay them against the side of it, cover with a hoe, and tramp firmly. The remaining dirt can be thrown back with a cultivator.

Of course, it should be distinctly understood that these methods are only for the common broadleaf species when the right conditions exist, and will result in failure when applied to larger trees or evergreens. The important thing in all cases is to have the soil come into close contact with the roots; otherwise the air will get in and dry out both soil and roots. It is a good practice to set deep enough so that when the operation is finished the trees stand in a shallow depression. This will catch the rain and materially increase the chances of success in a dry season. An essential element in planting is suitable weather. Occasionally there are springs in western Kansas when it is altogether useless to set trees unless water can be supplied whenever needed. The planter who raises his own seedlings can take advantage of favorable conditions, have his trees perfectly fresh, and set when he pleases, or even let them wait until another year.

CULTIVATION.

Successful forest planting on the plains, where the rainfall is light and the evaporation great, depends largely upon the proper cultivation of the plantation. Nature has bountifully pro-

vided us with a deep, rich, easily worked soil, which the farmer is learning how to utilize best. The abundant crops which are sometimes produced with the poorest methods of cultivation have tempted many to use more land than could be well handled, but experience is proving that for a succession of years there is no question about the increase in financial returns to be secured by better systems of culture. The wheat-grower formerly thought that if he plowed his ground once in two or three years he was doing well enough. Now he has discovered that it pays to plow every year. Similarly the early tree planters often set their trees carelessly and left them to struggle unaided with dry weather and native vegetation. Now the planter knows that trees, too, respond most encouragingly to good cultivation.

The object of cultivation is twofold: First, to prevent the growth of weeds and grass; second, to conserve soil moisture. The natural supply of moisture in western Kansas is sufficient for the needs of several species of trees, provided it is fully utilized by the trees and not allowed to escape through evaporation or be diverted by weeds and grass. There is not enough to warrant any wasting. Before the trees are set the ground should be thoroughly worked and put into good condition. Virgin sod, unless very sandy, should be broken and farmed to other crops for two or three years prior to the planting of the trees. Deep plowing, followed immediately by the harrow, saves moisture and makes the soil easily penetrable by the roots. After setting, cultivation should be shallow and frequent. An ideal method is a surface cultivation as soon as possible after every rain. The nearer this ideal is approached the better the results will be. The dust mulch is the best mulch of all to save the moisture already in the ground and keep the soil in good condition to receive the next that comes.

The advantage to be gained by long continued cultivation of a forest plantation makes a rather wide spacing advisable, and with some species will necessitate some pruning of the lower limbs. The wide spaces between the rows, how-

ever, can be largely compensated for by setting closer in them. The common spacing of plantations under the provisions of the Timber Culture Act was 4 by 4 feet. Trees set this way could be cultivated for only a very short time. A 2 by 8 spacing gives the same number per acre and permits much more satisfactory cultivation. For species which need more room, a 3 by 8 or 4 by 8 spacing can be used at first, while with increasing age and size the space required for cultivation can be obtained by thinning. The less cultivation that is to be given to the plantation the thicker the trees should be set. Where the soil moisture is not conserved by cultivation, the stand must be thick enough to finally establish forest conditions of shade and litter, if the plantation is to succeed. It is undoubtedly true that on the plains wide spacing and frequent cultivation will produce better trees than close spacing and little or no cultivation.

Aside from the preparation of the ground for planting, the plow has no place among trees and should not be used thereafter. Too often it is the case that the plantation is neglected until the weeds have formed a dense mass 3 or 4 feet high, and then in desperation a plowing is given, not followed by a harrow of any kind. The plow leaves the ground rough, thereby greatly increasing the loss of soil moisture through evaporation. A dead furrow is formed between the rows, or the earth is thrown away from the base of the trees and many roots are cut, so that the root system is injured and the growth of sprouts encouraged. The man who is not willing to take proper care of his trees deserves to lose them, and quite likely he will.

The best tools for the preparation of the surface of the ground and subsequent cultivation are the Acme disc and dagger-tooth harrows and the five-tooth cultivator. The Acme harrow is an excellent tool for shallow cultivation, and, used frequently enough, it is all that is necessary most of the time. Another thing in favor of the Acme is the ease and rapidity with which it works. The western farmer, with his

hundreds of acres of land and thousands of bushels of grain, has learned the value of riding implements and rapid methods. He may ride an Acme harrow among his trees and still be sure that he is doing the best thing by them. The one-horse size is 3 feet 6 inches wide and the two-horse 6 feet 6 inches. Where the weeds have made a strong start, an ordinary cultivator may be put in or a shallow disking given; but the disk should be set quite slanting or followed by a harrow to produce the best surface conditions. Dagger-tooth harrows are made in five-foot sections, so a single section and one horse can be conveniently used between the rows of trees. The five-tooth, one-horse cultivator requires the least space of any of the tools mentioned, and can be used when the rows are quite close together or after the trees have filled most of the space.

An excellent example of the extent to which cultivation can replace irrigation is furnished by the Rainbelt Experiment Station at Cheyenne Wells, Colorado. The station was established in 1894 in a typical high plains region. The elevation is 4,200 feet, with water 260 feet below the surface. The annual precipitation is about 13 inches. An apple orchard set in 1895 contains fine, healthy trees, which have produced well. They are of the usual varieties common farther east, such as Ben Davis, Winesap, Janet, etc. The intention is to give two shallow cultivations monthly if possible. The tools used are a five-tooth cultivator and a dagger-tooth harrow with the teeth set slanting. While less has been attempted with forest trees at the station, there are some green ash a year older than the apples which are making good trees, and young honey locust are promising well. Since such good results have been obtained with apple trees, there is no doubt that the same method of cultivation would enable several species of forest trees to be successfully grown.

The Pomeroy model farm, at Hill City, Kansas, which has been practicing the "Campbell system" of cultivation since 1900, is a valuable experiment in methods applicable to the semi-arid re-

gions. While the main object is the production of wheat and other farm crops, considerable has been done with trees. Besides fruit varieties, Russian mulberry, soft maple, and white elm have been set. They are doing well so far, although it is a very unfavorable situation for the maple and only fair for the elm. Cultivation is given as soon as the ground can be worked after every rain. An Acme harrow is generally used, preceded by a disk in case the weeds get too much of a start.

In river and creek valleys, where water is from 5 to 20 feet below the surface, cultivation is not ordinarily necessary after the trees get thoroughly established. The same is true in many places on the upland, where there are shallow basins which catch the run-off from a considerable adjoining area. In such situations the supply may be increased by plowing furrows along slopes lying above the plantation to collect water which would otherwise be lost.

Mulching has been practiced to some extent—hay, straw, or manure being used. It is better to mulch than to let the weeds grow. The mulch also checks evaporation and keeps the soil in good condition. The complaint is sometimes made that long-continued mulching brings the roots too close to the surface, and then they are exposed if it chances to be removed. The mulch certainly furnishes a congenial harbor for mice and all sorts of insects. The best mulch in all respects is the dust mulch, secured by cultivation, while the most suitable place for the one of hay or straw is around trees set in the sod, where it is inconvenient or undesirable to cultivate. Along a hedgerow, for example, a mulch may be of much benefit.

Occasionally field crops are planted between the rows of young trees, but the person who has any regard for their welfare will not do so. The trees need all the moisture and should not be forced to divide with other vegetation. Corn is especially harmful. The roots will spread both down and out for 4 or 5 feet and take much more soil moisture than do the young trees. If any crop is to be planted, it should be a short-lived one of the garden kind, either

small truck or potatoes. Their roots do not spread far and are soon gone, while the return from them will be sufficient to pay for the cultivation which should be given to the trees were they planted alone.

A sure way to ruin a young plantation is to turn cattle into it. Even if the trees are too large to be broken off by rubbing, every branch within reach will go, and forest conditions of shade and undergrowth be destroyed, so that weeds and grass can easily get a foothold. The damage to large trees in situations where moisture is abundant is not so great, and the protection furnished to stock in such a case may be of more value than anything else. The principal injury to older trees is by trampling. A heavy soil becomes packed so that it is nearly impervious to water, while a sandy one is worn away, leaving the roots exposed.

WHAT TO PLANT.

In order to succeed in forest planting in western Kansas, a careful selection of species is as important as good care. Many kinds of trees can not be made to thrive, no matter how much cultivation be given, and the planter must in some cases be content with what he can get rather than what he wants. Experience has thus far demonstrated that 15 or 20 species of forest trees can be grown, and

no doubt the number will be increased by future experiments. The many past failures have taught valuable lessons, which are being heeded. Omitting the less desirable species, those adapted to various situations and purposes may be classified as follows:

UPLAND SPECIES.

For upland planting under ordinary conditions, the honey locust, Osage orange, Russian mulberry, and red cedar are of superior hardiness and may be relied upon for good results. Next in hardiness come the white elm, green ash, hackberry, and Scotch and Austrian pines, all of which do very nicely when properly cared for.

VALLEY SPECIES.

For valley situations, where the roots will eventually get the benefit of permanent water, all the upland species are excellent, and to them may be added in many localities the cottonwood, boxelder, soft maple, black walnut, and hardy catalpa.

COMMERCIAL SPECIES.

In favorable situations, where growth is rapid, these species may be profitably planted for commercial returns: Osage orange, black locust, Russian mulberry, and hardy catalpa.

MICHIGAN STATE AGRICULTURAL COLLEGE.

DESCRIPTION OF ITS COURSES IN FORESTRY AND THE EQUIPMENT FOR THIS DEPARTMENT OF ITS WORK.

THE course in forestry at the Michigan Agricultural College, an institution established in 1857, and the oldest in this country, was put into operation in September, 1902. It is a four-year course, designed to instruct students in agricultural subjects as far as they will be likely to have demand for it, and to afford an opportunity for students to prepare themselves for the profession of forestry. With the former

object in view, the freshman and sophomore years of the course are identical with the same terms in the agricultural course. The instruction in forestry proper occupies the junior and senior years, although the curriculum for the sophomore terms in all courses includes preliminary forest work. In the junior year there are 552 and 588 hours of class-room and field or laboratory work, respectively, of which 192 and 216 hours

are forestry. In the senior year there are 84 hours of class-room work in forestry, with an additional 624 hours in other lines, and 540 hours of field or laboratory work, of which 216 are in technical forestry.

In the junior year students study principles of forestry, forest botany, wood technology, silviculture, plant propagation, forcing of vegetables and flowers, economic fungi, sanitary science, logic and argumentation, English literature, voice culture and declamation, German, and military science. In the senior year the work includes the study of forest

of the native trees that were growing at the time of the founding of the college, in 1857, are still in a thrifty condition, and the campus now contains over 600 native and introduced species and varieties. The woods on the college farm comprise nearly 200 acres, used primarily for demonstration in this department, and, in addition, 3,000 acres of virgin forest in Oscoda county have been set apart for its use. For practical exemplification of modern lumbering methods, etc., it is proposed to spend two weeks during the latter part of the spring term of the senior year in the



ON THE CAMPUS, MICHIGAN AGRICULTURAL COLLEGE.

mensuration, protection, regulation, valuation, investigation, economics of forestry, diseases of trees, higher civil engineering, advanced German, advanced zoölogy, geology, meteorology, and military science. The aim is to give as broad training as possible consistent with the necessary technical work. Instruction is given by practical demonstration in the nursery; in the 200 acres of land on the college farm, set aside for this purpose; on virgin timber near by; through lectures, textbooks, and other literature. The opportunities for practical work in forestry at the college are particularly good. Many

forests and logging camps of northern Michigan.

As stated, forestry students during the freshman and sophomore years do the same work as those taking the agricultural course.

The schedule of subjects pursued in the two latter years of the forestry course is as follows:

Junior Year—*Fall term*.—Principles of forestry, including three hours per week class-room work, and four hours laboratory or field work per week; forest botany, two hours per week class-room work; horticulture (pomology), five hours per week class-room work;



CORNER OF NURSERY, MICHIGAN AGRICULTURAL COLLEGE.

botany (economic fungi), nine hours per week laboratory work ; English (logic and argumentation), three hours per week ; political science (political economy), five hours per week ; military science (drill), three hours per week first half of term.

Winter term.—Principles of forestry, three hours per week class-room work ; forest botany, two hours per week class-room work and four hours laboratory work per week ; wood technology, eight

hours per week laboratory ; horticulture (forcing vegetables and flowers), ten hours per week laboratory ; English (English literature), three hours per week ; English (voice culture and declamation), one hour per week ; German (elementary), five hours per week ; military science (drill), three hours per week second half of term.

Spring term.—Forestry (silviculture) three hours class-room and four hours field or laboratory work per week ; forest botany, two hours of class-room and four hours of field or laboratory work per week ; botany (physiological) six hours per week laboratory ; English (voice culture and declamation), one hour per week ; bacteriology and hygiene (sanitary science), two hours per week ; German (elementary), five hours per week ; military science (drill), three hours per week.

Senior Year—Fall term.—Forest mensuration, eight hours per week laboratory or field work ; history of forestry two hours per week class-room work ; civil engineering (higher surveying)



VIEW IN THE PINETUM, MICHIGAN AGRICULTURAL COLLEGE.

five hours per week class-room work and field practice; German (elementary), five hours per week; zoölogy (systematic and economic), five hours per week; military science (drill), three hours per week.

Winter term.—Forest protection and regulation, two hours per week class-room work, first half of term; forestry (diseases of trees), two hours per week class-room work, second half of term; forest investigation, six hours per week laboratory or field work; German (advanced), five hours per week; civil engineering (agricultural engineering), five hours per week; geology (structural and historical), five hours per week; military science (drill), three hours per week, last half of term.

Spring term.—Forest investigation, four hours per week laboratory or field work; forest valuation, three hours per week class-room work; German (advanced), five hours per week; geology, five hours per week; meteorology, five

hours per week; military science (drill), three hours per week.

The course in forestry at the Michigan Agricultural College enjoys the advantage of having several subjects—those that bear on the subject of plant propagation, plant classification, and soils—taught in the departments of agriculture, horticulture, and botany. During their course, students sit under the instruction of nearly thirty professors and assistants. With the facilities and opportunities offered at this college, it is expected that the man who completes the course will be well prepared to begin his professional work as a forester.

Judging by what it has already done, this new department in the Michigan Agricultural College, an institution that claims the distinction of being the oldest of its class in the country, bids fair to uphold the enviable reputation already sustained by it in all its other departments.

IRRIGATION PROJECTS FOR WYOMING.

RECLAMATION SERVICE PLANNING TO
RECLAIM 150,000 ACRES OF ARID LAND.

IN a report recently transmitted to the Chief Engineer of the Reclamation Service by Jeremiah Ahern, district engineer, it is stated that it is proposed during the next few months to complete the construction of a wagon road and a telephone line, in connection with the Shoshone Project; to make borings at the dam site; to make designs of various structures; to continue the location surveys of canal and tunnel lines, and topographic surveys of the irrigable land.

The wagon road is being constructed into the canyon over which to transport material to the tunnels and dam site. The main canal and tunnels are being staked out on the ground, and a topographic survey of additional lands is under way, and designs and a study thereof are being made for an impounding dam of increased height.

The Shoshone Project contemplates the utilization of a portion of the surplus water of Shoshone River for the reclamation of land in the northern part of Big Horn county, Wyoming. Shoshone River receives its water from the high mountains adjacent to and east of the Yellowstone National Park. The North Fork rises near the eastern boundary of the park, a few of its tributaries having their sources within its limits. For the first few miles of its course it flows southerly, then easterly for about 45 miles to its junction with the South Fork, which comes from the southwest and is of about the same length as the North Fork, but discharges a smaller quantity of water. Just below the junction of the two forks, Shoshone River enters a canyon $3\frac{1}{2}$ miles in length. Beginning at the upper end of this canyon and for a distance of $1\frac{1}{2}$



THE BIG HORN RIVER, WYOMING.

miles the canyon is through solid granite. The narrowest place in this part of the canyon is 65 feet wide at the bottom, and at an elevation of 250 feet above the bottom it is 200 feet wide. After leaving the canyon the river flows northeasterly through a generally rolling country to its junction with Big Horn River, near the northern boundary of Wyoming. From the mouth of the canyon to a point some 60 miles down the river, areas of bench land lie on both sides of the river.

The drainage basin of Shoshone River above the canyon contains approximately 1,250 square miles, nearly all of it being within the Yellowstone Forest Reserve. A comparatively small portion of this water has been utilized.

Surveys made by private parties previous to the field work of the Reclamation Service in 1903 indicated the feasibility of several alternate projects, and in order to test the relative merits of all

alternate projects it was decided to make a topographic survey of all the irrigable land, and of all feasible conduit lines in the canyon. Preliminary estimates show that the construction of a high line canal is feasible, the cost of the entire work proposed being less than \$2,250,000. These preliminary plans were passed upon by a board of engineers, and on February 10, 1904, the Secretary of the Interior set aside \$2,250,000 of the reclamation fund for the construction of the project, "provided that satisfactory rights to land and water be secured, and provided that further consid-

eration of details on the ground by consulting engineers results in favorable reports."

The canal lines as located cover 103,000 acres of land, of which 93,000 are irrigable. By extending the main canal through the "Bad lands" below Garland, it is estimated that 40,000 to 50,000 acres additional, in the vicinity of Frannie, Wyoming, may be reclaimed. The total area reclaimed will probably exceed 150,000 acres. This land is at an elevation varying from 4,000 to 5,000 feet above sea level. Power for pumping water to land above the canal may be generated at several places. All of the land under this project has been segregated.

Preliminary surveys and reconnaissance work have also been carried on to considerable extent to determine the feasibility of storing water in Lake De Smet and at the headwaters of Grey Bull River.



FOREST RESOURCES OF TEXAS.

THE SPECIES OF TREES, THE KINDS OF FORESTS,
WHERE LOCATED, UPON WHAT DEPENDENT FOR DIS-
TRIBUTION, AND HOW THEY SHOULD BE MANAGED.

OF all the states in the Union, Texas has the largest wooded area; nor does this include the chaparral growth extending throughout the Rio Grande country, but only the vast timber section of east Texas and the central and far western woodlands. These are estimated at 64,000 square miles. Much of this territory has been cut over, especially in the shortleaf and longleaf pine sections; but conservative estimates still place the merchantable forest area of Texas at 27,000 square miles. There is now annually cut about 125,000 acres of timber land, yielding about a billion board feet. The lumber industry is exceeded in value only by the cotton and cattle industries. In its forests Texas has 61 species and varieties of trees of commercial importance.

The most valuable forests commercially are those in the eastern part of the state. This is because that is the region of abundant moisture. These include the swamp and bayou forests near the Louisiana boundary; on the more elevated lands a little farther west a range of hardwoods, and then the three great pine types of the state. Next to these on the west are the post-oak lands, extensive but of low commercial value, while to the south and southeast is a coast-plain belt of heavy live oak, which is rapidly spreading over the prairie. Directly west again come the "cross-timbers," with the post oak of the Carboniferous area, while to the southwest are the 15,000 square miles of Edwards Plateau timber; then, after a big jump across country, in the extreme western and high section of the state, are found the piñon pine, red fir, and other Rocky Mountain species. These are the great east and west timber subdivisions; but running down the river courses to the Gulf are the alluvial bottom hardwoods, and then from the extreme southern point of the state and from the Gulf coast in Brazoria

county, with a broad sweep to the north and northwest up to the top of the Pan Handle, is the pervasive chaparral growth. This last is persistently in the area of small rainfall, a product of the arid regions.

In the swamp and bayou forests there is at present little lumbering. There has been extensive cutting from the hardwood forests for railroad construction supplies, but the vast body of this timber in east Texas remains untouched, and offers a splendid field for the hardwood manufacturer. Of the total annual output of the state the longleaf pine forests now furnish about 750,000,000 board feet. Half of these forests have been cut over, and it is estimated that if a billion board feet are cut annually their timber supply will be exhausted in fifteen years. Under present conditions renewal is impossible, because of the manner in which lumbering is conducted and the prevalence of forest fires. There must be education of the people as to the terribly destructive effects of fires, penalties enacted to limit their occurrence, and conservative lumbering methods inaugurated at once, if Texas is to retain any longleaf pine forests of commercial value. Already its shortleaf pine forests are pretty thoroughly exhausted. The loblolly pine is very abundant and commercially valuable, and is found in close mixture with hardwoods in east Texas. The forests of the post oak and live oak lands and the Edwards Plateau furnish trees which are of little commercial importance, but they are most valuable for fuel and small construction timber. Especially is this true of the cedar brakes, which extend 200 miles northwestward from Austin and furnish not only the best of fuel, but posts, cross-ties, and sills. The chaparral growth is of no value commercially.

Texas has a serious task ahead in the management of its forests. The interests of the state as a whole demand protect-

ive forests. Texas has sold nearly all of its forest lands, and could not establish forest reserves without repurchasing on a large scale. It is doubtful whether the people of the state would, at this time, favor such a policy. So that any general system of conservative forest management must be put into effect by private individuals, who now own 95 per cent of the commercial woodlands. In this management large benefits, both public and private, will come from the proper control of the woodlot and larger tracts. In this work every farmer in Texas can be an assistant. By protecting and properly utilizing his own little tract of woodland he can not only raise his own fuel and farm repair material, but can also contribute his mite toward helping to reforest the state, and thereby increase the reserve water supply. To this end the practice of forestry becomes a very important matter all over that state. The two great causes of complaint there are heat and drouth. Both can be mitigated by preserving and extending, where proper, the forests of the state.

There is one phase of the question, however, that goes beyond the power of the private owner. It is when, for instance, the relations of the lowland farmer to the upland cattle grazer are considered. The latter can not be expected to regulate his affairs for the benefit of the former to his own real or sup-

posed detriment. The cattleman on his river watershed grazes his cattle and burns the prairie without any regard to what effect it will have on the flow of the river, upon which the lowland farmer is so dependent. And it is here that state action and protection should come in. The rough hillsides, canyons, and eroded slopes of the headwaters and middle courses of the rivers should be kept under good forest cover. Properly safeguarded with this permanent forest cover, the flow of Texas rivers would be far better regulated than now. Danger from floods, that almost annually destroy great crop areas and much valuable property, would be materially lessened. What is still more important, these protective forests would cause a storage of water, to be given out in regular supply to streams and thus made most available for use in the dependent agricultural sections.

For the last two years the Bureau of Forestry has been engaged in a careful study of forest conditions in Texas. Its collaborator in that work, Prof. William L. Bray, has now prepared a bulletin entitled "Forest Resources of Texas." This bulletin, which describes and classifies the forests of the state, deals with the determining causes of their distribution, and discusses fully both private and state management, will be issued soon.

SOUTH DAKOTA RECLAMATION WORK.

TERRITORY IN VICINITY OF BLACK
HILLS MAY BE RECLAIMED SOON.

THE Reclamation Service has received a report from Mr. Raymond F. Walter, engineer for South Dakota, which contains some interesting information in regard to the work being carried on in that state.

Attention has been given only to reclamation possibilities west of the Missouri River, and more especially to those in the vicinity of the Black Hills, and it is found that any reclamation attempted on any of the streams of this section

must be founded on storage of storm water and spring and winter flow. With this in view, the country around the Black Hills has been carefully investigated for storage possibilities and the north side has been selected as the most promising. This project is known as the Belle Fourche Project, the water supply being taken from the Belle Fourche River and its tributaries.

The Belle Fourche River rises in the east central portion of Wyoming and

flows northeast, then east, draining the western and northern portions of the Black Hills. This project involves the reclamation of the lands to the northeast of the Black Hills, in Butte and Meade counties, South Dakota, by the diversion of the waters of the Belle Fourche and Red Water rivers into basins east of the town of Belle Fourche. These basins are to be converted into storage reservoirs by the construction of embankments of earth, ripped with rock, across the outlets.

The reservoirs will be filled by a large feeder canal from the river, 6 miles long, 40 feet wide on the bottom, and carrying 10 feet of water. This supply will be augmented by water from Crow, Owl, Indian, Horse, and Willow creeks, which have large flood flow during certain periods. From these reservoirs the water will be distributed to lands in the valley on both sides of the Belle Fourche River, where between 60,000 and 100,000 acres of land may be reclaimed, depending on the water supply obtainable, the records not being sufficiently near completion to fix the amount at the present time.

In April a field force made a reconnaissance survey to determine the possibility of an increased water supply from the Little Missouri River and the storage of water so obtained. During May, 1904, the Secretary of the Interior gave his preliminary approval to the project, and conditionally set aside \$2,100,000

for its construction, if final report is approved by him. The organization of the land-owners under the project has been begun, and will be similar to that of the Salt River Valley Water Users' Association.

The diversion canal from the Little Missouri River to the Belle Fourche River will be located during the present season, and a reconnaissance made of the headwaters of the Little Missouri and Belle Fourche rivers for any possible storage to impound the excess flood waters and act as an equalizing basin. If a possible site is located surveys will be made.

In addition to the Belle Fourche Project, there are a number of other projects in the Black Hills district that are receiving some attention with a view to future reclamation. The most important of these are on Rapid Creek and Little Missouri River, where some preliminary surveys have been made and the water supply is being investigated. This work is being done principally in connection with the work of gaging streams in South Dakota.

Other reconnaissances and surveys will be taken up as opportunity offers. Numerous gaging stations have been established and maintained on the various streams, and miscellaneous measurements are made whenever opportunity permits on the smaller streams in the district.

STUDY OF THE RED GUM.

RAPID GROWTH, OCCUPATION OF SWAMPY LANDS, AND IMMUNITY FROM FIRES ATTRACT ATTENTION TO THIS TREE AS A MEANS OF CONTINUING THE LUMBER SUPPLY.

RECENT investigations of the Bureau of Forestry indicate an important addition to the present timber resources of the country through the better utilization of the red gum. This timber tree is the predominant species on the hardwood bottomlands of all the South-eastern States. In spite of its abundant supply, it has been slow to reach commercial importance because of the extent to which it warps and stains in

seasoning. While hickory, oak, ash, and yellow poplar were cheaply obtainable, red gum received little attention. The increasing scarcity and rising price of more adaptable trees have forced the gum into a market place of late, and have caused lumbermen to seek, with partial success, such methods of handling it as would obviate the difficulties which have stood in the way of a larger use of the wood.

In common with all the hardwood bottomland species—ash, cottonwood, and oak—its growth is very rapid. It reaches a maximum height of 140 feet and is commonly 30 to 40 inches in diameter, while trees of five feet in diameter are not infrequently found. Little red gum has been cut in the past, and at present it hardly pays to cut below 18 to 20 inches in diameter; so that this species furnishes a magnificent supply of full-grown timber in regions where culling has removed most of the larger trees of other kinds. The wood is comparatively straight-grained, free from knots and blemishes, and, because of its abundance, cheap. It is now used extensively for building timbers, flooring, boxes and barrels, and for numerous purposes where narrow boards can be used. It has been found that wide boards are very liable to warp.

Sixty per cent of the barrels and boxes manufactured in the Mississippi Valley states are now made from this wood in spite of the fact that its heaviness is against it for this use. Large quantities of gum are shipped to England, France, and Germany to be manufactured into furniture and interior furnishings, and it has been used extensively in Europe for paving blocks. It can be successfully steamed and bent and is thus available for barrel staves, wagon rims, and carriage wood stock. If the tendency of the lumber to warp and stain during seasoning can be prevented, its use will extend into many new fields. Certain facts have lately been discovered which show that such an extension is possible if proper methods of handling are employed. The heartwood can be air-dried without great stain or warp. Sapwood, however, if air-dried directly after coming from the saw, usually develops a large percentage of sap stain, which is caused in the case of most all conifers and hardwoods by a fungous growth which develops under certain conditions of humidity and temperature in the lumber yard, but it has been found that lumber from logs which have been allowed to remain in water for six weeks stains very little. Treatment with live steam has also been found to produce very favorable results

in the elimination of staining and prevention of warping.

In steam kilning the timber is thoroughly soaked in live steam for 48 to 72 hours, and is then dried by steam radiation for from 72 to 144 hours, according to the condition of the timber. The boards should then be air-dried for from two to three months. Lumber above one inch in thickness is air-dried only. Care must be taken in piling for air-drying to secure free circulation of air. Plenty of open space should be left between the boards, and the piles should not be over six feet wide. "Stickers" or cross-pieces of non-absorbent wood should be placed not over three feet apart. For this purpose oak and the heartwood of gum answer excellently. Stickers of sappy or undried wood are very likely to cause stain to develop. By following these methods the lumbermen are able to furnish a better grade of timber, which has in consequence secured a firmly established place on the market.

The Bureau of Forestry is now making, at its timber-testing laboratory at Lafayette, Ind., extensive tests to determine more fully the value of gum timber in comparison with higher-priced materials. Mechanical tests are made on timber collected from various parts of the country, including samples taken from both mature and immature timber at different parts of the trunk. The young trees contain a greater proportion of sapwood than the mature trees, and show about 35 per cent greater strength. The strength of the wood is very uniform in the trunk between the stump and the first limb. The results of the tests point to the fact that red gum timber has a high degree of strength as compared with other species, not only in small selected sticks, but also in large joists. Its freedom from knots in large sizes is an advantage in this respect. A joist of red gum will carry as great a load as a joist of North Carolina pine.

Comparisons have been made by the Bureau between red gum and hickory to determine the ability of the former to serve as material for carriage and wagon wood stock. No trouble was found in making satisfactory bent pieces for buggy

shafts and wagon rims, and the red gum promises to take the place of cheaper grades of hickory, oak, and ash for these purposes. The principal objection is that at the present time no satisfactory process of drying has been devised to overcome the warping and twisting of red gum in the larger sizes, but plans are now being made for a series of experiments to determine the proper operation of a kiln to this end.

An important question for timber owners in the region where red gum abounds is, whether management for future production will be a wise business policy. This question the Bureau of Forestry has been investigating during the past winter with interesting results.

Red gum forests are now beginning to be lumbered on a very extensive scale. The lands which they occupy are usually more or less swampy alluvial bottoms. While often very fertile they are apt to be subject to floods, and the cost of drainage is often high. Whether they will pay better if kept in timber or whether they should be sold for farming is a somewhat difficult question. One great advantage for forest management which they have over pine lands, for example, is their comparative immunity from fire. The owner of a good forest of red gum is not in danger of seeing his whole investment go up in

smoke. The red gum is a swamp species, and its rapid growth points to the conclusion, at least in certain sections, that the land can be profitably held for a second crop.

The field studies carried on by the Bureau of Forestry during the last winter were made on the lands of the Himmelberger-Harrison Lumber Company in Missouri, and on the tract of the Santee River Lumber Company in South Carolina. Figures on rate of growth in height, diameter, and volume were obtained, which will be later embodied in tables showing the rate of growth, age, and contents in board feet of trees of various diameters. A careful study of second growth and stand per acre was also made, and on these data it is hoped recommendations can be made for the management of these hardwood bottom lands so as to obtain a continual supply of timber.

Other studies have secured the data for a discussion of the reproduction and other characteristics of the red gum and of lumbering methods employed throughout its range. In addition, an inquiry has been made into the subject of market conditions and the uses and manufacture of the wood. All these phases of the investigation will be fully discussed in a bulletin, in course of preparation, on the red gum as a commercial timber tree.

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A publication relating to the expedition, issued recently by G. P. Putnam's Sons, New York, stands peculiarly and uniquely alone. The author, Mr. Olin D. Wheeler, is well known as the writer of the popular Wonderland series of the Northern Pacific Railway, in connection with which he made his studies and researches for this more pretentious work.

Mr. Wheeler has traveled several thousand miles over the old route of Lewis and Clarke, on railway trains and steamboats, in rowboats, afoot, on horseback, and in buggies or wagons. He has traveled with pack trains, camped out, and climbed mountains, in following the old Indian trails that the explorers followed and in visiting remote points made memorable by them. He has sojourned among Indian tribes, some of them now almost extinct, that Lewis and Clarke visited, and he has talked with one old squaw who, as a child, saw Lewis and Clarke.

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"The Trail of Lewis and Clarke" is illustrated in color and half tone from paintings, drawings, and maps made under Mr. Wheeler's direction, and from photographs taken by professional photographers who accompanied him for the purpose.

The original manuscript journals of Lewis and Clarke were studied by the author, and exact excerpts and photographic reproductions, in half tone, of their pages and drawings are given.

The Louisiana Purchase Exposition at St. Louis, and the Lewis and Clarke Centennial, to be held at Portland, Oregon, in 1905, to commemorate the great exploration itself, make this work by Mr. Wheeler peculiarly timely and apropos, because it is written by the only person who, from actual travel over, and investigation of, the Lewis and Clarke route, can write from the standpoint of actual knowledge of past and present conditions of the old trail and country.

Bulletin of the Michigan Ornithological Club.
Published by the Club, at Detroit, Mich., quarterly.

The first issue of this bulletin for the present year is a most creditable one, and should be seen by every ornithologist in the country for its three articles on Kirtland's warbler, one of the rarest and most interesting of all American

birds. The writers have each taken a different phase of the bird's life, so that the trio of essays is complete and adds much to the present knowledge of this warbler and its habits. For careful editing this bulletin is to be especially commended.

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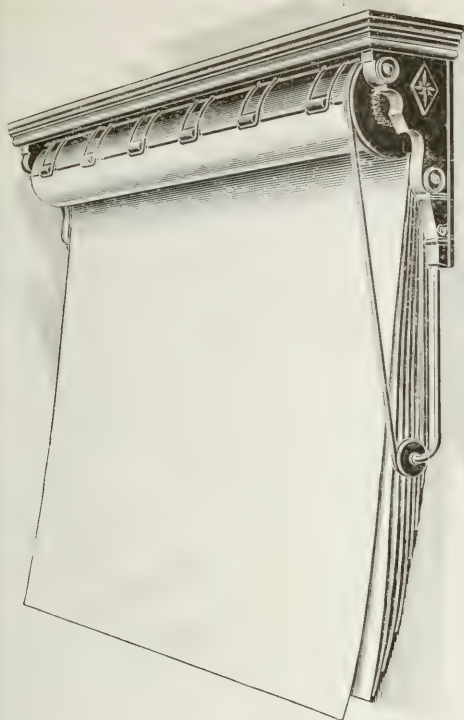
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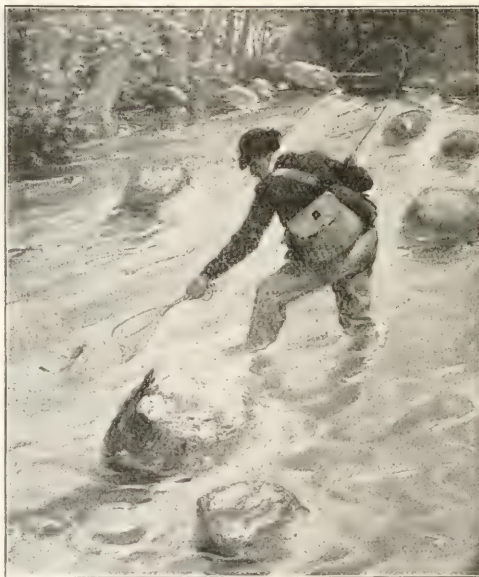
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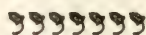
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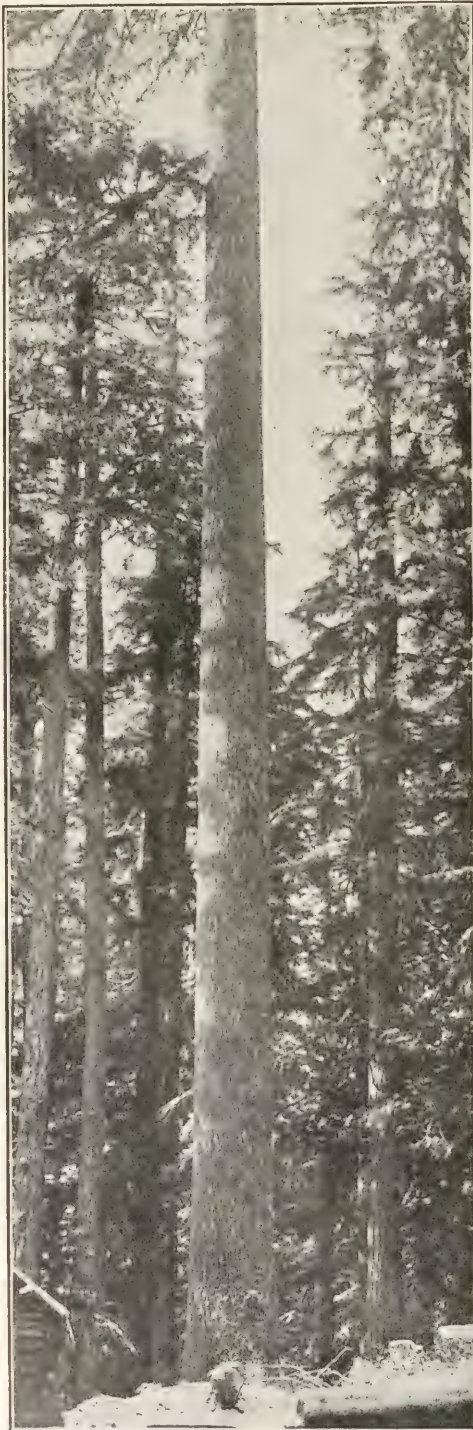


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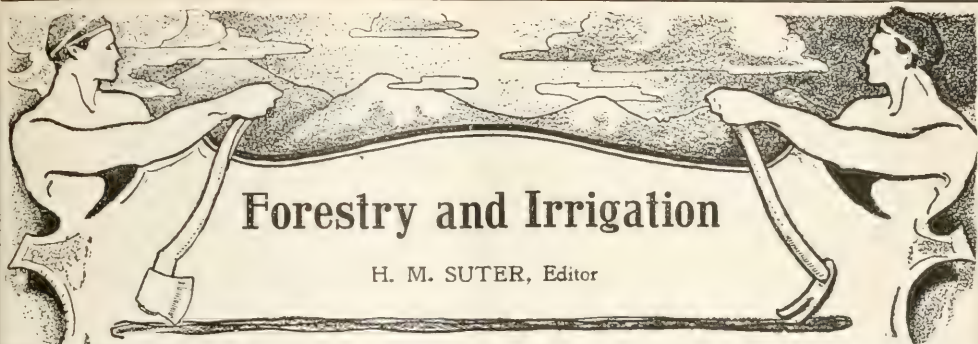
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Forestry and Irrigation

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VIEW OF LANDS TO BE IRRIGATED IN NEVADA BY THE FEDERAL GOVERNMENT.

Forestry and Irrigation.

VOL. X.

AUGUST, 1904.

No. 8.

NEWS AND NOTES.

Irrigation Congress.

It has just been officially announced by the committee on arrangements that the Twelfth National Irrigation Congress will be held at El Paso, Texas, November 15-18. Further particulars of this interesting event are published on page 380 of this issue.



State Forestry in Massachusetts.

Massachusetts now has a state forest service authorized by law. The law went into effect July 1, and the official to be known as the state forester was appointed by the governor. The law provides that the incumbent must be a trained forester with a technical education. It shall be his duty to promote the perpetuation, extension, and proper management of the forest lands of the state, both public and private. He shall also give a course of instruction to the students of the Massachusetts Agricultural College on the art and science of forestry. The salary of the state forester is \$2,000 a year, and the appropriation for carrying on the work during the present year is \$5,000.

Governor Bates has appointed to the position of state forester Mr. Alfred Akerman. Mr. Akerman is the son of former Attorney General Amos T. Akerman, of Cartersville, Georgia. He is a graduate of the University of Georgia, and later studied forestry at the Yale Forest School and at the University of Tübingen, Germany. He has served a year as assistant professor of forestry at the Yale Forest School, and has also been a field assistant in the Bureau of Forestry. Mr. Akerman is well equipped for his work, both from the standpoint of technical education and practical experience in forest work.

Constructing Engineer Examination.

An examination for constructing engineer under the Reclamation Service was held by the Civil Service Commission April 1, 1904. The compensation offered was from \$3,600 to \$4,800 per annum. About 230 engineers entered papers for this position. These papers were examined and marked quite severely, the average marking being between 65 and 75 per cent. Out of the 230 papers 60 were given a rating higher than 70 per cent.

Appointments have been offered to the three men who stood highest on this list, namely, Thomas F. Richardson, of Clinton, Mass.; Chas. E. Wells, Clinton, Mass., and Alexander E. Kastl, of Denver, Colo. This practically closes the matter, although the list of eligibles can under existing practice be utilized by various branches of the government service who may desire to select men from it for other positions.



Ontario Guards Against Fire.

The Commissioner of Crown Lands has just issued a code of very strict regulations for the observance of all persons exploring, prospecting, hunting, or pleasure-seeking on the now extensive forest reserves of Ontario. They will be rigorously enforced, and are as follows:

"Every person entering on this reserve shall, when requested to do so by the superintendent or rangers, furnish his name, address, proposed duration of his stay, parts of reserve he intends to visit, and such other information as the superintendent or rangers may require.

"No person shall prospect for minerals in any forest reserve except by authority of a permit in that behalf issued by the Commissioner of Crown

Lands, for which a fee of \$50 per year shall be charged.

"No person shall, except under the authority in writing of the Commissioner of Crown Lands, cut down, take the bark off, or otherwise injure any standing or growing timber in any forest reserve.

"No person shall be permitted to set out or start a fire for any other purposes than cooking or obtaining warmth, except by express permission of the Commissioner of Crown Lands.

"To start a fire for cooking or warmth observe the following precautions: Select a bare rock whereon to kindle such a fire, if possible; if no such rock is available, then select a site on which there is the smallest growth of vegetable matter, dead wood, branches, brushwood, or resinous trees; clear the place for the fire by removing all vegetable matter, dead trees, brushwood, branches, and dry leaves from the soil within a radius of 10 feet from the fire; exercise and observe every possible precaution to prevent such fire from spreading and carefully extinguish fire before quitting the place.

"Any person failing to comply with the provisions of the act for the protection of forests from fire, or of the forest reserve regulations, shall be subject to a fine of not exceeding \$50 for each offense.

"All persons acting as guides to parties of tourists or others must produce a license, which may be procured by approved persons from the superintendent of reserves, or the chief fire ranger in charge of any reserve, on payment of the annual fee of \$1.

The superintendent may cancel the license of any guide upon being satisfied the holder has violated any of the provisions of the act to preserve the forest from fire, the act to create forest reserves, and the regulations thereunder, or the laws for the protection of fish and game.

The fire rangers in a forest reserve are also game wardens, and authorized to arrest, without process, any violator of the game laws for an offense committed in his presence, and the said rangers shall with reasonable diligence

cause him to be taken before any justice of the peace for trial."

Irrigated Farms About 150 farms lying in townships 18 and 19 north, ranges 28 and 29 east, in Nevada, are now open to homestead entry under the terms of the reclamation law of June 17, 1902.

These farms are from 40 to 160 acres in area, and will be furnished with water from the government canals and reservoirs at a cost of \$26 per acre, payable in ten annual installments.

The maps showing the location and extent of each of these farms are in the hands of the General Land Office, and entries can be made under the homestead act subject to the limitations of the law of June 17, 1902.

The land is to be given away to persons who will live upon it for five years and who will pay the cost of bringing water to the land, namely, \$2.60 per acre for ten years. After that time the water-supply system becomes the property of the water users owning the lands.

Public Land Commission. Mr. Gifford Pinchot, Forester of the United States Department of Agriculture, and F. H. Newell, Chief Engineer of the United States Reclamation Service, both members of the Public Lands Commission, recently left Washington on an extended trip through a number of the public-lands states. Their time on this trip will in a great measure be devoted to collecting information bearing on the various public-land problems. On August 3, 4, and 5 they attended the meeting of the National Live-Stock Association and others interested in the public lands held at Denver. On August 7 they arrived at Boise, Idaho. Mr. Pinchot will spend some time in the vicinity of Boise, and will arrive in Spokane on the night of August 13.

Mr. Newell's program, meantime, is as follows: August 6, Boise, Idaho, public meeting; August 8, Ontario, Oregon, in connection with the Malheur irrigation project; August 10, Pendleton,

Oregon, to meet the Oregon State Commission for Revising Water Laws: August 11, at Walla Walla, Washington, to meet the Washington State Commission for Revising Water Laws: August 12, Walla Walla, Washington; August 13 and 14, at Pasco, Washington; August 15, reaches Spokane and meets Mr. Pinchot, traveling together during balance of the trip; August 16, they leave Spokane; August 17, at Wallace, Idaho; August 18, Missoula, Montana; August 19 and 20, Helena, Montana; August 21 and 22, Great Falls, Montana, and vicinity; August 23 and 24, Sun River, Montana; August 25, 26, 27, and 28, Marias River; August 29 and 30, Malta; August 31, at Buford, Montana; September 2, arrive at St. Paul, Minnesota; September 3, in St. Paul; September 4, in Chicago; September 5, Washington, D. C.

These dates are approximately correct, but subject to change.

Classification of Foresters.

A new classification of technical grades in the Bureau of Forestry went into effect July 1. This change was made in order to provide a set of generic titles that would tell more clearly what its men are doing. The titles are more easily distinguished, are more dignified, and mean more to the men themselves.

The new grades, with the yearly salaries they carry, are given below:

Forester, \$1,800.

Associate Forester, \$2,700-\$3,000.—Chief of the ranking division and assistant to the Forester.

Assistant Forester, \$2,100-\$2,600.—Chiefs of divisions and men occupying positions of similar responsibility.

Forest Inspector, \$1,800-\$2,000.—Chiefs of the ranking sections of divisions and men in charge of independent lines of work of similar importance.

Assistant Forest Inspector, \$1,500-\$1,700.—Chiefs of sections of divisions, except of the ranking section, and men occupying positions of similar responsibility.

Forest Assistant, \$900-\$1,200.—Men who enter the Bureau through the examination for Forest Assistant and have

not yet been given charge of independent lines of work.

Forest Agent, \$700-\$900.—Men without civil-service standing, in charge of subordinate lines of work.

Forest Steward, \$300.—Men whose service is temporary and educational in character and whose training in forestry is incomplete.

Promotions of Rangers.

Mr. O. Chandler, third-class ranger in the San Bernardino Forest Reserve, has been promoted to second-class ranger.

Philip Begue and R. H. Hiatt, third-class rangers in the San Gabriel Reserve, have been promoted and are now second-class rangers.

Underground Waters of Louisiana.

To no state in the Union has a copious supply of deep-well water been a greater boon than the State of Louisiana. The use of underground waters for the irrigation of rice fields has led to the sinking of an unusually large number of wells in the southern part of the state, especially in the region along the coast, where values in some localities have increased five to ten fold within the last ten years through the reclamation of the land by irrigation. Water-supply and Irrigation Paper No. 101 of the United States Geological Survey, entitled "The Underground Waters of Southern Louisiana," recently published, contains a great deal of information that may be of value to people interested in the industrial development of Louisiana. It was written by Prof. Gilbert Dennison Harris, of Cornell University, and Mr. M. L. Fuller, of the Survey, has added a discussion of the uses of the water for water supplies and for rice irrigation.

Professor Harris discusses the origin of artesian and deep-well waters in southern Louisiana. He presents facts showing that neither gulf waters nor river waters are the main sources of supply of the deep wells, and holds that the normal precipitation is entirely sufficient to account for the well supply.

The annual rainfall of about 55 inches is more than double the quantity necessary to irrigate the land if it were planted in rice. Much of this water is undoubtedly lost by flowing away in surface streams to the gulf or by leaching out into the gulf underground. Owing to the fact that the main local streams of southern Louisiana have never been gauged, the amount of water that reaches the sea, even by surface streams, is not yet known. Without proper hydrographic data, such as the United States Geological Survey is accumulating in many districts, it is impossible to even approximately estimate the extent to which the total amount of rainfall may be utilized here as deep-well water.

The topography and stratigraphy of southern Louisiana are discussed in considerable detail by Professor Harris, who shows how they modify the character and the condition of the water. The bulk of the paper consists of well statistics. Numerous wells throughout the various parishes are described and records are given, where possible, of their depths, the strata they penetrate, and their flows. The variation in flow and pressure-head shown by wells east of the Mississippi and by those west of that river is discussed. Professor Harris concludes with a chapter on well drilling and pumping.

In discussing the increased use of underground waters in southern Louisiana, Mr. Fuller speaks of them as sources of town and domestic, of farm, railroad, and manufacturing supplies. Extensive tables are given to show the extent and importance of the use of well and combined well and bayou systems for the irrigation of rice in Louisiana. The method in which the water is applied and the land farmed is also described.

Forester for Ontario.

Dr. Judson F. Clark leaves the Bureau of Forestry during the present month to become Provincial Forester of Ontario, Canada, a position recently created by its government. He will organize a Division of Forestry in the Crown Lands Department. Dr. Clark is a graduate of the agricultural

college at Guelph, Ontario, and later pursued graduate studies at Cornell University. Following this he was an instructor in the New York State College of Forestry up to the time of its discontinuance. Dr. Clark made an excellent record while in the Bureau of Forestry, and he goes to his new position highly recommended by its officials.



To Test Seeds. A circular recently issued by the U. S. Department of Agriculture should go a long way toward breaking up the traffic in bad seeds. The circular runs as follows:

"The act of Congress making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1905, contains the following:

"The Secretary of Agriculture is hereby directed to obtain in the open market samples of seeds of grass, clover, or alfalfa, test the same, and if any such seeds are found to be adulterated or misbranded, or any seeds of Canada bluegrass (*Poa compressa*) are obtained under any other name than Canada bluegrass or *Poa compressa*, to publish the results of the tests, together with the names of the persons by whom the seeds were offered for sale."

"Announcement is hereby made that the collection and testing of seeds as directed by this act will begin July 1, 1904.

"JAMES WILSON,
"Secretary."



Forest Fires. It is interesting to note how conspicuous is the absence of serious forest fires in several states which have enacted forest-fire laws and directed a rigid enforcement of the same. Realizing the import of the saying, "A stitch in time saves nine," several measures designed to prevent the occurrence of forest fires have been promulgated by the Ontario government, and especially are these regulations designed to safeguard Crown lands from damage by railroads. New York State wardens have been vigorous this season in the matter of prosecu-

tions for infringement of the state forest laws, and prompt action by state forest officials and forest-reserve rangers in several states have in many cases averted serious damage. Reports from the State of Washington indicate that forest fires are again prevalent, although not in the same territory as those chronicled in the July number of *FORESTRY AND IRRIGATION*. Four different fires were reported in Kings county on July 12, and it is reported that about 800 acres of fine timber were burned over. Damage was also done in the territory surrounding the Tulalip Indian Reservation. By far the most serious fires of the past month, however, have been in Newfoundland and British Columbia. The area of destruction in the interior of Newfoundland is stated to be greater than that affected by any previous conflagration. Notre Dame Junction, a lumber settlement, was all but consumed, and several lumbering firms have suffered extensive loss through destruction of their outfits and plants. Canadian newspapers place the loss in Newfoundland alone at \$175,000, including loss

incurred in the destruction of buildings, lumbering outfits, mills, and timberland. Nova Scotia and New Brunswick have been visited by numerous minor forest fires, owing to the favorable conditions of drouth and heat. On the other side of the Canadian domain serious damage has been done in the northern Saanich district of Vancouver Island, and in the mountains near Ladysmith. In the northeast of Wulffsohn Bay a fire of considerable magnitude is reported to have destroyed a large acreage of timberland.

A small fire engaged the attention of forest rangers near Prescott, Arizona, in the early half of July, and during the same period a serious fire was reported in the Huachua Mountains near Tombstone. Forest fires in this section are of a more serious aspect than the actual monetary value of the property destroyed implies, since their protection of the water supply is vital and the welfare of the country greatly dependent upon their influence.

California suffered losses in two localities—in the Yosemite, at the foot of Mount Starr King, and in Sierra



HEADGATE OF AN IRRIGATION CANAL, ON THE NORTH PLATTE RIVER.

county, at the foot of Beckwith Peak. Forest fires have been prevalent in the district between Bayfield and Port Wing, in Wisconsin, practically the same territory which suffered in May. A widespread area of dry slashings offers a favorable opportunity for the fire to gain headway. A minor blaze near Escanaba, Michigan, created a scare among residents of that town as to the safety of outlying buildings, but no damage was done. The fires in the Mogollon Mountains of New Mexico, near Silver City, which, as stated in our June issue, were extinguished, broke out again during July.

Some loss was occasioned lumbermen in Maine by fires in scattered localities during the last week of June. The most serious of these occurred in Washington county, but through prompt action on the part of State Land Agent Ring serious damage was averted.



Stream Measurements. During the past two months the stream measurement work of the U. S. Reclamation Service, which was started in the early spring in the Western States, has been extended into new territory, which is being examined for irrigation purposes.

In Colorado new stations have been established during June as follows: La Plara River and Canal at Hesperus, Laramie Canal at Glendevey, on the Little Grizzly at Hebron, and on McIntyre Creek at Gleneyre. Aside from these stations, surveys and measurements were made on the North Platte and its tributaries in North Park, Colorado.

In South Dakota new stations were established in connection with irrigation investigations at Seim on Grand River, on Indian Creek at Sanoma, and on Moreau River at Bixby.

In Idaho stations have been established on various canals in different portions of the state in order to determine the amount of water now being used for irrigation purposes.

Gaging stations were established in Utah during April, May, and June as follows: On Logan Creek at mouth of

Canyon, Blacksmith Fork at Toll Gate, and also at Aqueduct Toll Gate, Jordan River at the pumping plant, Rock Creek at Duchesne, and on Logan River at Smithfield and Hyde Park.

Mr. E. C. Murphy, inspector of stream-gaging work of the U. S. Geological Survey, is now in the flooded district of Kansas making a careful study of the causes and extent of damage done by the recent floods in that state. During the past year Mr. Murphy has been making a careful study of previous floods in this and other sections of the United States, the results of which are contained in water-supply paper entitled "The Floods of 1903." This pamphlet will be ready for distribution in the near future. In connection with this subject several gaging stations have been established in the flood district of Kansas in order to determine the flood flow.



Hydrographic Aids. Albert I. Stiles and Leroy Hunter, hydrographic aids, have been assigned to the field force of Engineer George L. Swendsen, Salt Lake City, Utah. Mr. Stiles is a graduate of the Leland Stanford University, and Mr. Hunter is a graduate of the Massachusetts Institute of Technology, Boston. Both men have had considerable field experience and will be valuable additions to Mr. Swendsen's force.



In the Dakotas. The growth of planted trees in the two Dakotas will be studied this summer by a field force of the Bureau of Forestry. Some little work of inspection has previously been done in those states, but the possibilities of tree planting there are relatively unknown. The country is high and level for the most part, though broken here and there by canyons and small streams. There is less planted timber than in Nebraska. The plantations are usually the work of those who took up timber claims. Unlike much of the planting under the same law elsewhere, that done in the Dakotas was generally not perfunctory,

but careful and intelligent. Those who took up claims planted not only because it was necessary to make their titles good, but, since they felt the need of trees, they cultivated them properly, and they are now rewarded with valuable assets in their plantations. This growth will be carefully examined and measured as a basis for recommendations concerning scientific tree planting and management.

The field force this summer will be six experts, divided into two parties. They will begin in the southern part of South Dakota and work northward, covering both states east of the 99th meridian.

The topography and climate of the Dakotas make tree plantations essential to the highest development of the rich agricultural lands. The rainfall is less than in Nebraska or Kansas, but this is largely neutralized by the shorter crop seasons. The winds in summer are hot and dry, and of about the same velocity as in the two latter states. Because the rainfall is so small and the evaporation, accelerated by the high dry winds, is so great, trees in abundance are required to offset these disadvantages. Properly selected, and planted as shelterbelts and windbreaks, trees will greatly increase the yield from all crops by cutting down the force of the wind and conserving moisture.

The creation of woodlots is one result of tree planting that should specially appeal to the residents of the Dakotas. The long and bitterly cold winters necessitate the use of an enormous amount of fuel. This fuel can be grown within a few hundred yards of the house, far more cheaply than coal or wood can be delivered by the railroads. The woodlot will not only furnish fuel, but also, if the trees have been properly chosen, all fence posts and general repair material needed.

Woodlots need not be planted as a separate venture. They can be grown in connection with and partly as the result of the establishment of shelterbelts. The wider these are made, to a certain limit, and the more thoroughly they are extended around the farm, the greater the advantage in crop protection

and the larger the annual cut of wood obtainable.

The first object of the Bureau of Forestry in its work in the Dakotas is to ascertain if the trees now growing there are the species that can be most profitably planted. The study will also cover the methods and cost of the tree planting that has been done, with the expectation of offering suggestions for improving those methods and lessening the cost. The results of this work can not fail to be decidedly advantageous to the farmers of those states, who, it is to be hoped, will further the work by offering the field parties all the information and assistance in their power to give.



Tree Planting in Illinois. The Bureau of Forestry will this summer pursue in Illinois a study

from which it is expected material advantage will inure to the vast agricultural interests of that state. Planted timber will be made the subject of careful examination to determine what kinds of trees make the most rapid growth and are most valuable commercially and for use as windbreaks under the prevailing conditions of soil, moisture, and cultivation. The topography of Illinois is such that a forest cover is not usually needed to protect the soil from erosion. The land for the most part is rolling or level prairie, rich and admirably suited for agriculture. A farmer reaping large harvests from his lands naturally will not consider putting those lands to a less profitable use, but experiments have proved that shelterbelts, in protecting the lands from wind, influence a larger crop yield.

Shelterbelts are invaluable in protecting crops from the damage frequently resulting from the full force of destructive winds, but possibly their chief value is in conserving the moisture so absolutely essential to crop growth. Wind is a strong ally of evaporation. It is established that as the velocity of the wind increases, evaporation is very rapidly augmented. Shelterbelts, in opposing the wind, effectively retard evaporation, and thereby save to growing

crops the soil moisture necessary to keep them thrifty during dry, windy times. These facts are especially pertinent in a treeless, level agricultural country, where the wind has an unobstructed sweep for miles and gets constantly drier in its course. The strips of land that farmers in Illinois might divert from agriculture in creating shelterbelts would be put to better use than if continued in crops, because the remainder of the land would be so much benefited by the change. Nor is protection from the effects of wind the only advantage that would be secured from the creation of shelterbelts. If composed of suitable kinds of trees, shelterbelts can be made to answer the purpose of valuable woodlots, furnishing all the fuel, fence posts, and farm-repair material the farmer may need. The two uses will admirably go hand in hand, and between them will materially improve the value of the land and the comfort of the farmer.

To promote this end the Bureau of Forestry has assigned to Illinois for this summer a field party of five experts, under the supervision of Mr. R. S. Kellogg. They will study both native and planted trees to gain a full understanding of the rate of growth and reproductive powers of the trees which are the most valuable for the state. Data will be collected relative to the cost and methods of planting and the time required to grow timber to the size required for usefulness. When the study is completed a full report on the subject will be published.



Geographic Congress.

The Eighth International Geographic Congress will be held in this country next September. The Committee of Arrangements has invited all bureaus of the government that are concerned with geographic work to appoint representatives at this Congress.

The subjects for treatment and discussion at this Congress may be classified as follows: Physical geography, including geomorphology, meteorology, hydrology, etc.; mathematical geography, including geodesy and geophys-

ics; biogeography, including botany and zoology in their geographic aspects; anthropogeography, including ethnology; descriptive geography, including explorations and surveys; geographic technology, including cartography, bibliography, etc.; commercial and industrial geography; history of geography; and geographic education.

A special opportunity will be afforded for the discussion of methods of surveying and map-making and for the comparison of these methods as pursued in other countries with the work of the federal and state surveys maintained in this country.

The National Geographic Society of Washington, D. C., as the organization responsible for the management of the sessions in the United States, will play the part of host and welcome the Congress, on September 8, to its new home, the Hubbard Memorial Hall, on Sixteenth street, in Washington. Sessions will be held there on September 9 and 10. Leaving Washington on the 12th, the members, associates, and guests of the Congress will be entertained during that day by the Geographical Society of Philadelphia, and on the 13th, 14th, and 15th by the American Geographical Society in New York, where scientific sessions will be held. On the 16th they will have the opportunity of visiting Niagara Falls, and on the 17th will be entertained by the Geographic Society of Chicago. On the 19th and 20th they will be invited to participate in the International Congress of Arts and Science connected with the World's Fair, in St. Louis. If there is sufficient demand, a Far-West excursion will be provided from St. Louis to the city of Mexico, Sante Fé, the Grand Canyon of the Colorado, San Francisco, and the Golden Gate, with a return by any preferred route through the Rocky Mountains and the interior plains to eastern ports.



San Francisco Reserve.

A study of forestry seems to be especially esteemed in countries where there are no longer forests to study. In furtherance of this work, the United States Geological Survey has just

published Professional Paper No. 22, which bears the title "Forest Conditions in the San Francisco Mountains Forest Reserve, Arizona." This paper embodies the results of investigations made during 1901 and 1902 by John B. Leiber, Theodore F. Rixon, and Arthur Dodwell, and is prefaced by an introduction written by F. G. Plummer, which is particularly interesting.

The San Francisco Mountains Forest Reserve comprises portions of the broad summit and slopes of an elevated tract of land in north-central Arizona, which includes the southern part of the Colorado Plateau. The northern part of the area is dotted by several hundred volcanic cones and the southern part is gashed by numerous deep canyons. The altitude of the region ranges from 3,500 feet at Oak Creek, in its southwestern portion, to 12,794 feet at the summit of San Francisco Peak.

Among the coniferous trees in the reserve the western yellow pine constitutes over 99 per cent of the total forest. The aspen takes first rank among the broad-leaved species, but has a close competitor in the oak. The chief lumber tree at present is the western yellow pine, which is extensively cut and furnishes all of the mill timber sawed, used in, and exported from the region. Its average total height is 85 feet, with about 10 feet of clear trunk. The diameter averages 18 inches, which corresponds to an age of 180 years. In the 812,500 acres of forest area examined, 2,743,558,000 feet, B. M., of standing timber were found, which gives an average of only 3,377 feet, B. M., per acre. It is evident that the western yellow-pine stands, even where entirely untouched by the ax, do not carry an average crop of more than 40 per cent of the timber they are capable of producing. This condition is chiefly attributable to the numerous fires which have swept over the region within the last two hundred years, destroying seedling and sapling growth.

The chief agencies through which the forests in the reserve suffer destruction are cutting, grazing, and fire. Logging operations have been carried on in most of the central forested areas that are tributary to railroads. The forest has

been culled or cut from 148,845 acres. The timber cut on these tracts has been converted into tie, stull, or round mining timber and saw-logs.

Grazing, especially sheep herding, is ruinous to the seedling growth of a young forest. Sheep are especially fond of the young aspen, which spring up as the first restockage on the non-forested park lands at the base and on the slopes of San Francisco Mountains. It was found that the destruction of seedlings on any particular tract of land ranged from 50 per cent to total after a single passage over such ground by 2,000 head of sheep.

Fires have been of frequent occurrence in all portions of the reserve. The badly burned areas, on which the destruction has been 60 per cent or more, aggregate 6,790 acres. The origin of fires in recent years may, in part, be ascribed to the carelessness of sheep herders, in part, to sparks from engines on the Atchison, Topeka, and Santa Fé Railroad, but by far the largest number of fires are due to lightning, and this cause has, of course, always operated. Sections exist on which 50 per cent of the mature western yellow pine has been either wholly or in part killed by lightning strokes.

Among other interesting questions considered in this paper are the low reproductive ratio of the yellow pine, the influence of the forest on run-off, the grazing value of the reserve, and the effects of sheep herding on the forest floor. The bulk of the paper is devoted to detailed descriptions of the areas, by range and township, that make up the reserve.



Hydrology in Western States.

Mr. N. H. Darton, geologist in charge of the western section of hydrology, United States Geological Survey, left for the field June 20, to spend five months in supervising the work of assistants in various portions of the West. He will make an examination of the western slope of the Bighorn Mountains, and will spend several weeks in the region lying north of the Black Hills in order to obtain material required to complete a report

on the "Geology and Underground Waters of the Region North of the Black Hills." Later in the season further work will be done in the Arkansas Valley, in southeastern Colorado, to complete the data for a report on that important artesian district. Visits will be made to a number of dam-sites in various portions of the West for the purpose of ascertaining the geological conditions in each locality. Investigations of special problems of underground waters will be made in Nevada, Idaho, Arizona, and New Mexico.

Investigations of the underground water resources and geology of southern California will continue under the direction of Mr. C. W. Mendenhall. Much of his attention during the early part of the season will be devoted to the preparation of reports and maps for publication.

Mr. C. E. Siebenthal, assistant geologist, has been directed to continue his examination of the San Luis artesian basin, Colorado. When that work is completed, he will investigate the prospects for artesian wells in the Uncompahgre Valley, and at the end of the season will examine the prospects for obtaining deep-seated waters in the area at Denver, which has not so far been fully explored by deep wells.

Mr. C. A. Fisher will continue his studies of the geology and underground water resources of the Bighorn basin, in northern Wyoming. He will also examine the coal deposits and determine the prospects for oil and gas in that region.

Mr. G. B. Richardson has been assigned to a study of artesian problems in the eastern part of the Salt Lake basin, in Utah. In this region numerous wells are found, but the underground waters present many variations in conditions of occurrence. During the first part of the season Mr. Richardson will finish his work on the geology and waters of El Paso, Texas, with the view of completing a geologic folio on the El Paso quadrangle.

Mr. Willis T. Lee will make a reconnaissance of Owens Valley, California, where it is believed the underground water conditions are similar to those

in some of the valleys in southwestern California and south-central Arizona. Later in the season Mr. Lee will continue his observations in the Gila Valley, Arizona, with a view to ascertaining the extent of the area in which underground waters are available, their volume, and the best means of utilizing them for irrigation.



Hydrographic Work in East.

The hydrographic work in the New England States, which has been organized and carried on under the direction of Mr. N. C. Grover, of the United States Geological Survey, was transferred to H. K. Barrows on July 1. The following number of stations are being maintained in this district: Maine, 18; New Hampshire, 12; Vermont, 3; Massachusetts, 3; Rhode Island, 1, and Connecticut, 1.

A systematic study is being made of the developed and undeveloped water power in Massachusetts, Connecticut, and Rhode Island, and other gaging stations will be established in these states at an early date.

In Maine profiles are being made of the lower portions of the Penobscot and Kennebec rivers. In connection with these profiles surveys are being made of those portions of the rivers which are well adapted to the purposes of the Survey.

Mr. N. C. Grover, who for the past two years has carried on the hydrographic work in New England, has been transferred to the Washington office, where he will direct similar work in New Jersey, Pennsylvania, Maryland, Virginia, and West Virginia. A careful reconnaissance is being made in these states, and the work will be extended into new localities during the coming season.

In the Southern States Mr. M. R. Hall is maintaining 2 stations in Alabama, 24 in Georgia, 3 in Mississippi, 5 in South Carolina, 12 in North Carolina, and 10 in Tennessee. Of these stations several have been established during the present season, and special efforts are being made to investigate localities of undeveloped water power.



MR. THOMAS H. MEANS,

ENGINEER OF SOILS, U. S. RECLAMATION SERVICE.

IN this issue we print an article on "The Use of Alkaline and Saline Waters," by Thomas H. Means, Engineer of Soils, United States Reclamation Service.

Mr. Means is particularly fitted for this work, through long and careful training in the Bureau of Soils and through a close study of alkali conditions in this country, in Europe, in northern Africa throughout Algeria, the Sahara desert, and in Egypt. What makes his work of particular value is that it has been carried on in connection with irrigation problems, in which Mr. Means is expert, as those who read his articles on the Nile dams in *FORESTRY AND IRRIGATION* will readily understand.

Thomas H. Means was born at Waterford, Virginia, November 15, 1875, of good old Quaker stock. He received his education in the public schools of Washington and graduated a C. E. from Columbian University, besides obtaining degrees for work in chemistry and physics. He served in the Bureau of Soils for ten years before joining the Reclamation Service this spring, becoming head of the United States Soils Surveys, and establishing a reputation as the foremost authority on alkali problems in the country. His work from now on in connection with the reclamation service will be of signal value in determining the steps for reclaiming so much of the saline lands of our West, and his decisions concerning alkali, with the remedies he may propose to remove adverse conditions, will be of immense value.

THE USE OF ALKALINE AND SALINE WATERS FOR IRRIGATION.

BY

THOMAS H. MEANS,

ENGINEER OF SOILS, U. S. RECLAMATION SERVICE.

THE greater part of the water easily available for irrigation in the arid regions of the United States has been appropriated, and in many cases appropriation has gone so far beyond the easily available as to require extensive and costly irrigation works to bring the water to the land. As time goes on, the scarcity of water becomes more evident, and we are now confronted by large areas of excellent land, lying in a position very favorable for irrigation, with little or no water in the streams for the accomplishment of this irrigation.

In the effort to extend the area of irrigated land so as to include these unoccupied tracts, sources of water more or less contaminated with salt and alkali have been developed, and the application of these waters to the land has produced a new set of conditions worthy of our careful consideration. The fact that water contains much or little soluble matter seldom enters into the calculations of the farmer or engineer, and serious mistakes, involving heavy loss, have been made by the use of water containing excess of salt or alkali—mistakes often the result of lack of knowledge concerning the effect of salt and alkali upon plant growth. Cases, however, are on record where water has been condemned by chemists, but its use persisted in by canal companies or individuals to their serious loss. Again, on the other hand, well-meaning chemists have been prone to condemn sources of water as detrimental to plant growth, and in that way have seriously hampered the development of agriculture, when by proper methods of cultivation and irrigation this water might be used successfully and profitably. A number of cases have recently come to notice where pumping plants have been closed down by the advice of chemists, on account of the salt and alkali in the water, when such waters could be used a thousand years without detriment to the soil or grow-

ing plants if the farmer understood the proper methods of handling alkali waters, and in southern California and Arizona orange and lemon trees have been killed by the use of a slightly alkaline water when, by a very simple change in methods of irrigation, the trees could have been made to flourish. All this points to the fact that information upon the best methods of using saline and alkali waters is needed.

Chemists have made serious attempts to define the limits of the amount of various chemical salts allowable in a water to be used for irrigation. At the present time the statements seen in print are greatly at variance. Many statements are made largely from the result of laboratory studies, while others are made from studies over a very limited field. In work of this sort it is very difficult to determine from laboratory investigations how much alkali a plant will stand, and it is only by very wide observation of field conditions where alkali waters are in use that definite information can be gathered as to the limits of endurance of ordinary crops. For example, water is used on large areas of land in New Mexico and Arizona, and has been used successfully from ten to twenty years, which would be regarded with suspicion or condemned in California.

Studies carried on in the Department of Agriculture, Bureau of Soils, over the entire western irrigated area, led to the publication in 1899 of the following statement: "Five hundred parts of soluble matter may be taken as the extreme limit of endurance for plants, while 250 or 300 parts mark the danger point, at which the results of the use of the water are very uncertain."

At this same time other writers on the subject place the limit at 30 parts sodium chloride and from 173 to 300 parts of the less harmful salts per 100,000 of water. Thus it will be seen

that quite a margin existed between the limits set by the two authorities. Since then, in 1903, the writer published a short account of the use of saline waters in Algeria, where water with as high as 816 parts soluble matter was in successful use.

The interest in this subject warrants a more extended statement of the subject than has been made. Inquiries have been received from many quarters for more explicit information, and to answer these this article has been written.

In considering the fitness of a water for irrigation purposes there are a number of factors to be taken into consideration besides the amount and chemical character of the salts which it holds in solution. The most important of these factors are: the soil to be irrigated, its texture, depth, and amount of alkali salts present in it; the abundance of the water for irrigation, and the character of crops to be raised.

Certain salts, such as those of iron or copper, are very poisonous to plants, and very small quantities in water are sufficient to condemn such a water as dangerous or unfit for irrigation. Fortunately, the occurrence of such waters is rare, but waters pumped from mines or from waste, from mills and smelting works, is sometimes dangerous, and where trouble is experienced with water in mining districts where mills or mines are upstream, then metals should be looked for in the water.

LIST OF SALTS.

The salts most commonly found, however, are sodium chloride, or common salt; sodium sulphate, or Glaubers salt; sodium bicarbonate, or baking soda; sodium carbonate, or washing soda; magnesium sulphate, or Epsom salts; magnesium chloride, or bittern; calcium carbonate, or limestone, and calcium sulphate, or gypsum. This, though apparently a formidable list of salts, is much simplified when considered as regards the effect upon plant growth. The two salts of calcium are beneficial to plant growth, and are so slightly soluble that they can not exist in a water in harmful quantity, so need not be considered in an analysis. The remainder of the salts are divided into

two groups—black alkali, or sodium carbonate, and white alkali, or the other salts.

Of all the salts the sodium carbonate, or black alkali, is by far the most harmful. In ordinary irrigation practice plants will stand at least five times as much white alkali as black, and in irrigation waters the same relation will hold.

Of the white alkali salts, sodium chloride is generally the most destructive, its effect being approximately twice as harmful to vegetation as the rest of the salts. Of the other salts little can be said, except that they are the least harmful of those ordinarily found in irrigation waters, and that there is very little difference in their relative poisonous effect on plants.

Sodium carbonate has two effects on growing plants in the soil—first, the ordinary effect of any material in solution, whether that be an osmotic effect upon the cells of the roots (or whether it be due to the action of ions on these cells is a question still in dispute), and, second, a caustic action upon the vegetable tissues of the growing plant. This caustic action corrodes and dissolves the delicate portions of the plant below ground, and frequently immediately at the surface girdles the plant. By the application of gypsum or land plaster to a soil containing black alkali this caustic nature is neutralized and a chemical reaction takes place between the gypsum and sodium carbonate, forming one of the less harmful white alkali salts, sodium sulphate, and a relatively insoluble compound, calcium carbonate. This reaction can be utilized in the treatment of soils containing black alkali, but the high price of gypsum has not permitted this to be carried on to any great extent. Ordinarily under-drainage is cheaper. The same reaction can be utilized where waters containing sodium carbonate are used.

It has been recommended that water containing sodium carbonate in solution should be run through cribs filled with crushed gypsum. The reaction is, however, exceedingly slow. It would generally require several hours or days' contact to thoroughly neutralize the alkalinity. For this reason it is generally better, where black alkali waters are to

be used in irrigation, and where the black alkali remains in the soil, to apply the gypsum to the soil direct.

Sodium carbonate, or black alkali water, in contact with air, which always contains carbonic acid gas, undergoes a change, and is in part converted into sodium bicarbonate by the absorption of the gas. In this way the alkaline character of water is sometimes much ameliorated, for sodium bicarbonate is neutral in reaction, and from all available information is no more harmful than the other white alkali salts. In equilibrium with atmospheric air, there is a definite relation between the relative amount of carbonate and bicarbonate found, the percentage of the latter increasing with the amount of carbonic acid gas present. Thus when water containing sodium carbonate is applied to a soil, a certain definite portion is converted into the bicarbonate, a greater portion than would be converted in normal air, for carbonic acid gas is more abundant in soil air than in the air above the soil.

Whenever water containing sodium carbonate is used, every facility for under-drainage should be supplied to remove the excess of the salt, and should the black alkali begin to accumulate to the detriment of the growing crops, gypsum in a powdered form should be applied to the soil.

The following table shows the amount of sodium carbonate added to the soil in an acre foot of water containing a given amount of that salt, and the number of pounds of gypsum needed to neutralize all of the sodium carbonate. Part of the sodium carbonate may be changed to the bicarbonate and another part may be drained away, so that the figures for gypsum represent the maximum amount ever required, and in practice some smaller amount may serve.

Parts sodium carbonate per 100,000.	Pounds sodium carbonate in 1 acre foot of water.	Pounds of gypsum needed to neutralize the sodium carbonate.
5	136	221
10	272	441
15	408	662
20	540	880
25	680	1,100
30	820	1,320
35	960	1,540
40	1,090	1,760

The cost of gypsum varies so much that it is difficult to give the cost of the above applications. Ground gypsum or land plaster for agricultural uses should not cost much more than \$2 per ton. The average price varies from \$2 to \$3 per ton.

At these prices, if it were necessary to add the maximum amounts given above, the use of water of higher concentration would be very expensive; but it is thought that it will never be necessary to add but a third or half of this amount in practice, and less if the under-drainage is good.

Sodium bicarbonate is very frequently found in irrigation waters. In itself it is no more harmful than the other neutral salts. Evaporation of the water containing it, causes a portion of the bicarbonate to revert to the carbonate, and therefore waters containing sodium bicarbonate should be held open to suspicion, just as are waters containing the normal sodium carbonate. Where the water contains less than 100 parts sodium bicarbonate per 100,000, the amount of sodium carbonate formed under natural conditions will never amount to more than 20 per cent of the whole. The danger is in allowing such water to concentrate on the field, for the percentage of sodium carbonate possible increases with the concentration, and in water containing 300 parts, as much as 40 per cent of it may revert to the carbonate. For this reason the dangers from surface evaporation of waters containing sodium carbonate and bicarbonate are greater than in other waters, for beside the actual concentration, which in itself is harmful, there is brought about by the concentration the dangerous change to black alkali. Surface cultivation and under-drainage are therefore all the more desirable. So far as our information goes, water containing more than 50 parts of sodium carbonate per 100,000 should not be used permanently for irrigation purposes. If the land to be irrigated contains gypsum, as arid lands usually do, a larger per cent of sodium carbonate is allowable; and, again, if gypsum be easily available for agricultural purposes, or is on sale at a reasonable price—that is, not exceeding

two or three dollars per ton—greater concentrations may be allowed.

The ordinary method of chemical analysis of irrigation waters is certainly greatly at fault, for an analysis usually shows all the sodium carbonate and bicarbonate as sodium carbonate alone. This is generally determined by evaporating the water to dryness, which decomposes the sodium bicarbonate and leaves only the carbonate. Every 100 parts of sodium bicarbonate will by this method give 62 parts sodium carbonate, whereas, as has been shown, the reaction within the soil is ordinarily in the opposite direction, the tendency being toward the decrease of the sodium carbonate and the corresponding increase of the bicarbonate.

Of the white alkali salts, much larger amounts are allowable in water. The waters of the Pecos Valley in New Mexico average over 300 parts of soluble matter per 100,000 parts of water, and where this water has been intelligently used, the soils have remained fertile after fifteen years of irrigation. This water contains about 152 parts of salts, easily soluble, and likely to accumulate in the soil. In the Salt River Valley of Arizona the waters of the Salt River vary from 70 to 140 parts soluble matter per 100,000, containing from 40 to 100 parts sodium chloride, and have been in use for thirty years upon soils varying from loose sands to heavy clay and adobe, and where care has been exercised in the use of such waters, no trouble has been experienced from the rise of alkali.

The waters of the Buckeye Canal, taken from the Gila River about 20 miles below Phoenix, Arizona, carry about 200 parts of soluble matter, of which about 130 are sodium chloride. This water is used upon light and, in some cases, fairly heavy soils, and where carefully handled has not resulted in the accumulation of alkali in the soil.

During the summer of 1902 it was the writer's good fortune to visit some of the oases of the Sahara Desert in eastern Algeria. In these oases, artesian waters carrying very large quantities of soluble matter are successfully used for irrigation purposes. Waters carrying as high

as 810 parts per 100,000 parts of water were used in growing vegetables, while a number of wells carrying over 600 parts were in daily use, some of them carrying over 300 parts of sodium chloride alone. This water was used for the growing of fruit trees and vegetables, many of which are grown in our own country and are not considered especially resistant to alkali salt.

These amounts of salt in irrigation water are higher than those in common use in America, and it should certainly be encouraging to our engineers and farmers who, in developing underground water supplies, are constantly in dread of damaging their land by alkali.

Water containing 1,036 parts soluble matter was found too strong for permanent irrigation in Algeria, although there are places in Tripoli where sea water containing 3,500 parts of soluble matter is used occasionally for irrigating certain crops (date palms).

It should be remembered that the limit of endurance for most cultivated plants, in a water solution, is about 1 per cent, or 1,000 parts soluble matter per 100,000 parts water, and if every effort is made by the user of alkali waters to keep the concentration of his soil solution down to or below this limit there need to be no fear from alkali. It will be readily seen that every condition which favors the concentration of the water in the soil cuts down the limit allowable in the irrigation water, and, on the other hand, every condition which favors a ready flow of water through the soil and a low evaporation of water from the surface of the soil helps toward making it possible to use alkali waters in irrigation. To this end several methods of procedure offer.

It should be understood that the first requisite of any land under irrigation is good under-drainage. Where this is attended to or naturally present, frequent irrigation offers the simplest solution, for by this means the soil solution is kept dilute, and the excess of soluble matter which would accumulate after the evaporation of the water is washed down into the subsoil and into the drains. In Algeria, where the air and soil are intensely warm (when visited

by the writer the temperature in the shade reached 127° F.), the water is applied every two or three days during the summer. The soil was very light, and these frequent applications soon drained away. Where heavier soils are found, such frequent irrigation is by no means necessary or advisable, but a good watering once in ten days will be found sufficient to carry away all excess of accumulated salt.

In using saline or alkaline waters furrow irrigation is not advisable. All of the land should be covered, if not at every irrigation, at least occasionally, so there will be no high places on which the alkali can creep.

Where fresh water or water containing little or no alkali is available during a part of the year, occasion should be taken of this opportunity to use water

plentifully, so that the accumulations of alkali can be washed out of the soil and a store of fresh water left in it. Flood waters from western streams are generally better than the normal or low water flow. This is not always the case, however, particularly in the first flood which follows a dry period, for such floods sweep down the stream the alkali crusts which have formed, and often carry in solution large quantities of soluble matter.

Another method for the utilization of bad water has been suggested, and that is the growing of plants resistant to alkali. Date palms, pomegranates, pears, sugar beets, barley, sorghum, and asparagus are all more or less resistant and offer something in favor, over more tender species, to the farmer who must handle saline or alkaline water

AN OBJECT LESSON IN REFORESTATION.

HOW BARREN WASTES HAVE BEEN RECLAIMED IN FRANCE—NEARLY 700,000 ACRES OF CULTIVATED FORESTS NOW GROWING IN FRANCE—HOW TO SAVE THE SAND DUNES OF OUR COAST COUNTRY.

BY

ALBION W. TOURGEE,

U. S. CONSUL AT BORDEAUX, FRANCE.

THE growth of the maritime pine in the Landes and adjoining departments undoubtedly marks the most remarkable achievement ever wrought by human agency in the modification of natural conditions of soil and climate for the benefit of mankind. It is a marvelous demonstration not only of the practicability, but also of the almost boundless beneficence of reforestation. It demonstrates the fact that while human recklessness has swept forest and verdure from so vast an area of the Old World and the New human skill and care are able to reclaim the most barren and desolate regions with a growth which not only stays the advance of devastation, but reestablishes in its place the most healthful, agreeable, and profitable conditions.

At the beginning of the nineteenth century the region between the Gironde and the Pyrenees, excepting a narrow belt which skirted the southern bank of the river, extending inward from 50 to 100 miles, was not only one of the most barren in the world, but apparently almost hopeless of reclamation. For 100 miles along the shore of the Bay of Biscay there stretched a threatening array of gray sand dunes which year by year pursued their irresistible march toward the heart of the most productive land in Europe at a rate varying from 1 to 200 feet a year. One after another great waves of sand, moved by the restless winds that swept across the Atlantic, continued their unceasing march across the fair plains of southern France, burying all before them—fields,

meadows, vineyards, houses, churches, even villages—leaving behind them only gray billows, to which clung bunches of bracken, a few starved bushes of scrub oak, and thickets of white and purple gorse, fighting stubbornly for a hold upon the shifting sands, with here and there some straggling groups of pines, the protesting remains of a great forest which wind and sand and fire and water had spared.

On the seaward side the great furrows, lying one within the other, were

the steady western winds and the sand thrown up by the restless waves, ate away the forest and left only the shifting dunes—great sand billows that crept on inch by inch and year by year, entombing more of the bright-blossomed bruyeres and genets, no matter how bravely they fought for existence, leaving behind them only dry roots, which the “forestiers” gathered for their hearths. Wherever the foot of the sand dune rested, there was hopeless blight. A little wiry grass grew in the shadow



FOREST OF MARITIME PINE ON THE DUNES IN GASCONY. THE WHITE SAND IN THE FOREGROUND IS THE EDGE OF A FIRE LANE.

bare and gray. The western winds lifted the light sands (baring the roots of trees upon the seaward slopes) and dropped them just beyond the crest to drown and smother the shrubs which struggled up the leeward side. Here and there in favorable locations a few scattered pines marked the location of the ancient forests to which the Greeks and the Romans, perhaps even the Phœnicians, came for timber and pitch and left their names on the shore to mark the limits of forgotten commerce. They brought with them not only reckless greed, but still more reckless flame, which, coöperating with

of the heather and gorse, on which the sheep browsed, under the eyes of the solemn-faced shepherds perched on stilts and knitting as they watched. On and on crept the phalanx of the terrible dunes, slowly but surely blighting all in their path, not only creating a desert, but destroying hope. As long as the winds blew from the west the dunes marched to the east; the desert fires ravaged the intervening spaces; the flocks grew fewer, the desolation more extreme. In the heart of sunny France a desert was established, ever increasing in extent and threatening to stretch

across its fairest fields the aridness of the Sahara.

In the first year of the nineteenth century one of the sons of the doomed region had an idea. It was a simple one, but the times and circumstances were ripe for its adoption. It was that if the seeds of the maritime pine were gathered, sprouted carefully, and the young trees planted in advantageous positions, where the moving sands would not overwhelm them until their tough roots had taken a firm hold, their wiry leaves, which loved the briny spume, would offer no resistance to the wind, and, falling about their roots, would give shelter and nutriment until a forest grew which would hold the sands in check and save the threatened interior from desolation.

The idea was brought to the attention of Napoleon, in whose hands was not only the present, but the future, of France. He saw not only the danger, but the way to safety. His vision penetrated the centuries, and he saw the march of the deadly dunes arrested and the desert they had already created made to blossom like the rose. A

century has passed and the statue of Bremon tier looks down one of the great furrows which lie between the dunes he showed how to conquer and restore to verdant prosperity. Napoleon has added another laurel to that fame which makes his name almost a forbidden one to the peoples whom he forged into a nation of unique and marvelous solidarity. The greatest of all his victories is that by which the ever-increasing legions of the maritime pine are mustered along the coast from the mouth of the Loire to the Pyrenees to shelter the sunny plains from the assault of the sand-laden waves of the Atlantic and convert impending evil into an economic blessing. Today the dark squadrons of the maritime pine are posted on thousands of sandy slopes, faithful guardians in the shelter of which the vineyards and wheat fields rest secure. The gray dunes which were sweeping over the land have become serried fortresses, which shelter civilization and prosperity. Here, again, man has pitted himself against the destructive forces of nature and won, making the winds and waves his servants for the renovation of past



NATIVES OF THE FRENCH LANDES. MOST OF THE TERRITORY SHOWN IS NOW COVERED WITH PINE TREES.



A DUNE IN PROCESS OF FORMATION ON THE NEW JERSEY COAST.

evils and the establishment of future benefits. Lumber, firewood, resin, turpentine, and all the by-products of resinous distillation are now produced in such abundance here as not only to prevent the need of importation, but to make southwest France a considerable and profitable exporter of the same. Not only the finest lumber for domestic uses is produced, but railway ties, telegraph poles, fence and vineyard posts, and millions of the pit props which sustain the roofs of English collieries come from the eastern shore of the Gulf of Gascony, the ships that bring Welsh coals carrying back the supports which make the mining of coal possible.

SAND DUNES OF THE UNITED STATES.

The United States, which in the beginning of the nineteenth century had the monopoly of naval stores and the resinous products for which civilization makes increasing demand, now finds a rival in the maritime pine of

the dunes which were then worse than barren, and it is today a considerable importer through the port of Bordeaux of the finer products of resinous distillation. While we have wasted our abundance by reckless destruction of our forests, France, by intelligent conservation of hers through reforestation of her dunes, has made them productive and profitable. The one has developed wealth from barrenness and the other as rapidly evolved barrenness from lavish abundance. Dunes like those which a century ago threatened the prosperity of France are today making serious inroads on our Atlantic and Pacific seaboard. While France made enlightened appeal to the maritime pine and its associated growths to save her from threatened desolation, we have refused protection to the much richer long-leafed pines, which asked only opportunity to continue to pour wealth and favor upon our southern slopes. Will the conditions of a century ago be

reversed at the end of a century to come? From Maine to Florida and from Mexico to British Columbia the causes which made the dunes of Gascony instruments of devastation are at work almost without attempt on our part to limit their operation, while across the ocean, encouraged by the success of a wonderful experiment, the French are trying to find a way to change the character of still greater areas by reforestation of the Sahara, not by means of the maritime pine and its productive concomitants, but by the cultivation of trees and shrubs adapted to the climatic conditions of another continent. That the greater struggle with nature will succeed no one who considers the conditions there presented and the character of the people who have undertaken it can doubt.

LAND AND FOREST TENURE IN FRANCE.

It is a curious fact that social and political conditions have been not only an important factor of this climatic and

economic experiment, but there is a peculiar resemblance between the natural and the artificial conditions which have cooperated to insure success in this struggle between man and nature, which began on the shores of the Gulf of Gascony. The material struggle was carried on not by means of the maritime pine alone, but by it in connection with the undergrowth of all sorts native to this region. The function of this undergrowth was to shade the young pines until they could send their roots down into the moisture that percolates through the sand during the rainy period. In addition to this, they kept piling up the sands which were blown over the crest of the dune and made the foothold of the pines continually firmer, broadening the crest of each dune, and so promoting a mesa-like formation, instead of the sharp, wave-like crest of the dune. It is to the coöperation of these two forces—the deep-rooted pine with the low, clinging undergrowth—that the march of the smothering sands was stayed.



THE TOP OF A DUNE ON THE NEW JERSEY COAST HELD BY A PATCH OF BAYBERRY.



PLANTATION OF BEACH GRASS AND PITCH PINE ON CAPE COD FOR THE FIXATION OF THE SOIL.

In like manner the coöperation of different social and political forces was essential to the result. The tenure of lands in this region consisted of several elements, to wit :

1. The supreme national tenure—what we term the right of eminent domain—which applies to all the lands of France, and may be exercised with or without ousting private ownership. This secures to the government the right to supervise and regulate the planting of the maritime pine by the officers of the department of roads and bridges, so as to secure the best results by making each proprietor's coöperation contribute to the success of all. This power is seldom exercised except by way of suggestion.

2. Feoffage, or the relation which subsisted between the feudal lord and the inhabitants of his domain, to whom he granted certain privileges in consideration of more or less clearly defined services; forestiers, resiniers, and shepherds

all owed certain duties to their feudal lords—in this case, Capitaux de Buchs. The resiniers worked his forests for resinous products; the forestiers guarded his forests from waste and spoliation and preserved the game; the shepherds furnished wool and mutton in return for free pasturage. All had a right to gather dead branches in the forests and to use dead trees for housing. As a result, every inhabitant as well as the lord had a definable right in every acre of land and every tree in the forest. There was no such thing as an absolute individual proprietorship, but a triple one. The lord has lost his feudal right, but the French law has preserved, with singular discrimination, the right he held and the obligation he owed to his feudal servitors. These rights have, as a rule, been absorbed by the nation or distributed between the new proprietors and the communes, which are very properly held to have succeeded to the privileges he enjoyed and the obligations he owed.

3. In this distribution of rights and privileges the commune is held to have succeeded to most of the public rights and obligations of the feudal lord. The commune in which land once held by feudal right is situated, must prevent it from being enclosed, so as to destroy or unduly restrict the rights of pasturage or forestry, which have descended to the inhabitants.

4. The private rights or privileges of the feudal lord are held to have descended to the present occupants in all cases where it can be shown that they have acquired the same by purchase or inheritance. In the greater part of this region, however, the right of actual occupancy of the feudal lord was so vague and uncertain that it was impossible to define by metes and bounds the limits of alienation by inheritance or purchase. Because of this, the general forest right—that is, the right of hunting, cutting, enclosing, and working for resinous products—are held to have escheated to the state, and not to the heirs or purchasers, while the rights of communal enjoyment remain to the inhabitants or tenantry, modified only by conditions imposed by law. Every resident of the forest enjoys all the rights which attached to his ancestor—or the person whose right he has obtained by purchase—except as they may be modified by the action of the commune.

The result is that there are hundreds of square leagues on which the pines can not be worked for turpentine nor cut for timber. Over these free passage is allowed, and every habitant has a right to gather dead wood and utilize the common pasture. When one purchases or leases unoccupied land which has no timber on it the right of the habitant still subsists, and the trees, the proprietor plants, are subject to the same conditions as previously attached to the land purchased. He may extinguish the right of pasturage by negotiating with the commune and acquire from the government the right to work and cut the trees he cultivates, but the rights of the forestiers are held to be practically inextinguishable. They still have the right to gather dead wood and fallen timber even on the planta-

tions erected and cultivated by the occupant.

The result of these curiously complicated conditions is that every person living on an ancient feudatory has an individual, inheritable, and inalienable interest in every tree and shrub and every grain of sand in the common forest. There is no such thing as an absolutely exclusive ownership in any of the lands not distinctly aliened by the ancient feudatory. Such ownership can only be secured or exercised by special and concurrent grant of all the parties in interest—the state, the commune, and the occupant. By obtaining these the purchaser may obtain the right to enclose, to cultivate, or to work and cut to the exclusion of all others, but if his timber is killed by fire the rights of the forestiers to cut and use is held to attach, and can only be released by individual renunciation.

WHERE MARITIME PINE FLOURISHES.

The maritime pine is now planted in large quantities as a matter of profit by the owners of sandy lands which are properly located. As its name implies, it prefers an exposure to sea air and does not object to a subsoil having a brackish impregnation. It does not succeed where it meets a temperature below zero for any considerable time, nor in a continuously dry climate. A location subject to severe drouths, with a dry subsoil in a climate like that of the northern part of the United States, is not likely to prove suitable for the growth of this tree.

There are now nearly 700,000 acres of maritime pine growing in France, one-third of which is under control of the government and two-thirds in private ownership. The trees are usually grown in nursery rows, carefully protected by mulching or some sort of low growing shrubs or grain for two or three years, and then set out in the plantations. Those who have recently purchased seeds of this variety of pine for cultivation in the United States would do well to consider the essential characteristic of its habitat; also the fact that in removal from the nursery the roots must not be exposed so as to become

dry even for the briefest period. After twelve years they become, under ordinary circumstances, large enough to be "worked" for resin, which they continue to yield for thirty years, and are then cut for timber.

The lesson of this wonderful one hun-

dred years of experiment is not restricted to reforestation by means of the maritime pine alone, but extends to all woods used for that purpose, and is that the conditions of the natural habitat must in all cases be observed in order to secure success.

FORESTS OF THE HAWAIIAN ISLANDS.

FOREST DESTRUCTION A MENACE TO PROSPERITY—CATTLE VERSUS WATER—WHAT THE GOVERNMENT IS DOING TO BETTER CONDITIONS.

IN the Hawaiian Islands it is now recognized that forest preservation is a matter of great and immediate importance to the leading economic interests of the territory. The chief agricultural interest of the islands is sugar-growing. In 1903 the exported sugar was valued at \$25,310,684, or 96 per cent of the total exports. The supply of water on which successful cane cultivation depends comes to a large extent from the forested higher slopes of the mountains above the plantations. But the situa-

tion is complicated by the fact that cattle-raising, which in economic importance stands second only to the sugar industry, depends largely on the use of the forest for range, and overgrazing has been the principal cause of injury to the water-holding power of the wooded area.

As a preliminary to the formulation of a far-sighted policy in the interest of the islands as a whole, the territory a year ago asked for an examination of the whole question on the ground by



IE-IE VINE IN LEHUA FOREST.

an agent of the United States Department of Agriculture. The report of Mr. William L. Hall, of the Bureau of Forestry, who made the examination, is now being printed as Bulletin No. 48, "The Forests of Hawaii." Both from a scientific and practical standpoint, it gives much information concerning these Hawaiian forests and their uses.

Only five of the eight islands are large enough to be important in a forest study. In these there are two distinct kinds of forest—one near sea-level in the drier portions of the islands, the other in the

2 feet and a height of 50 feet. From it have sprung 50,000 acres of mesquite, or, as there called, algaroba forests, divided among the several islands. The wood is chiefly valuable for fuel and fence posts. The forests are exceedingly important as furnishing a cover for the soil and abundant food for stock. The mesquite pods are eaten by cattle in summer, as they fall to the ground from the trees, and are gathered and fed dry all through the year. Because of these uses and the wonderful powers of reproduction and extension which the



UNDERGROWTH IN A MOUNTAIN COVE.

regions of heavy rainfall on the mountain slopes. They never blend or even meet. The forest of the sea-level is made up exclusively of mesquite, so prevalent in the drier sections of the southwestern part of the United States. In the Hawaiian Islands, however, it grows much denser, taller, and straighter than in the States, having changed its habit of growth in response to altered conditions. It is not native, but was introduced in 1837 by a seed planted in Honolulu. The tree still stands in a healthy condition, having a diameter of

algaroba forests possess, they are a most valuable asset of the islands.

The native forests are those of the mountain slopes, and are all essentially of a tropical character. About three-fourths of the native forests are composed of lehua. This tree is found in regions of heaviest rainfall, and under best conditions attains a diameter of 4 feet and a height of 100 feet. Commercially, except for fuel, the wood has little value, for in drying it checks and warps badly. Its importance is as a protective forest. Its stand is thin, but



FOREST NEARLY RUINED BY GRAZING, NORTH KOHALA, HAWAII.



FOREST ENTIRELY RUINED BY GRAZING, MAUI.



KUIKUI FOREST, BOTTOM AND SIDES OF DEEP GULCH.

the most luxuriant undergrowth is always found beneath its small-crowned trees. Indeed, so luxuriant is this undergrowth of ie-ie vine and similar climbers, fern growth ranging from a few inches to 30 feet in height, and mosses, that virgin forests of lehua are often impenetrable, dark jungles. Thus an ideal condition is created for water conservation.

The present forest area is about 20 per cent of the islands—a small fraction of what it was a hundred years ago. The destruction of the forests can be traced to three chief causes—clearing for agriculture, stock grazing, and grass encroachment. Cattle were taken to the islands in the eighteenth century, and for years were protected by rigid laws forbidding their slaughter. By 1815 they had so increased in number as to become a menace. The anti-slaughter laws were repealed, and gradually their number has been re-

duced to the needs of the islands; but their work of destruction had been accomplished. Much of the undergrowth of the native forests was of a succulent character, peculiarly agreeable not only to cattle, but also to goats, pigs, and deer. All of these preyed upon the forest, and year by year their trampling and grazing showed more plainly in forest areas wrecked and ruined. The encroaching grasses occupied the ground and prevented reforestation. In the rainy districts the Hilo grass and in the drier sections Bermuda grass was the offender. Between them they occupy vast stretches of country that were once well forested.

Clearing for agricultural and homestead purposes is responsible for very much of forest destruction. Since the best

use to which the lands of the islands can be put is agriculture, no fault can be found with such cutting, provided it is not carried so far as to curtail the water supply on which agriculture itself depends. The rainfall of the forested portion of the islands is from 50 to 200 inches a year, and the native forests furnish the best floor conditions for storing away this water for future use, but when the forest area is made smaller the storage supply of water is lessened. In addition, it appears to be true in Hawaii that forests influence the amount of moisture precipitated. Where the mountains, with their cooling atmosphere, do not extend their elevations above 3,000 feet, forests are especially needed. The trade winds bring in fogs and mists, and the forests perform the excellent function of changing these to water and leading it to the ground for storage. Thus, continued forest cutting means danger both to the amount of

water precipitated and to the supply husbanded for the crops. Both the principal crops, sugar and rice, require much water for their successful growth.

Already public opinion in the islands has taken form in practical forest preservation work. Sugar companies have established reserves for local protection, the area in one case being as large as 50,000 acres. Tree planting has been done on a large scale by a number of land-owners. The government began tree planting twenty-two years ago with an appropriation of \$12,000. A conclusive step was taken when the last legislature provided for a forest policy, and entered upon determined work to protect and utilize the forests to the best advantage. The first act to this end must be the establishment of forest reserves, which should include practically all the mountain forests. Fortunately, the government owns most of these forests, although at present they are largely under lease to private individuals, mainly to cattlemen. It is thought, however, that an exchange of these lands can be brought about. When the reserves are established, a first necessity will be the extermination of the wild cattle and goats and the creation of a ranger serv-

ice to keep out fire and stock. Where reproduction is not rapid, and upon badly denuded lands, tree planting must be done to supplement the natural forest. It is believed that trees of greater commercial value than those native to the islands can be successfully planted.

The conflict of interests between the cattlemen and the sugar-planters is evident, but need not seriously menace rehabilitation of the forests. The cattlemen in many instances desire the forests for pasturage. The planters rightly contend for the intact forest with perfect floor cover to secure the greatest possible storage of water for the supply of growing crops. But the clashing of interests is happily reduced by other conditions, chief of which is that sugar-growing is the great sustaining industry and the dominant source of income. An additional potent factor is that many cattle-raisers are also sugar-growers, and their double interests compel them to take the broadest view of the needs of the islands as a whole.

The Bureau of Forestry has supplied the islands with a forester, and is actively coöperating with the territorial authorities in all matters of policy.

THE NEW MONTANA.

TO LEAD IN IRRIGATION AND MINING.

BY

GUY E. MITCHELL.

THE great copper, silver, and gold mines of Montana, the "Treasure State" of the Union, potent as has been their influence in her development, and while they are yet far from their maximum output and value, must soon take a second place in the state's resources. It is Montana's destiny to be one of the richest agricultural states in the Union. As the agriculture of Colorado, now the foremost state in the production of precious metals, has already outstripped her mines, so in a

few years will Montana's farming lead her mines.

With lands of surpassing fertility, in which agricultural plant food has lain stored for centuries, with no drenching rains to leach them away, and with a magnificent water supply from the rain and snows which fall upon the high peaks and watersheds of the Continental Divide; Montana's fat cattle and sheep, splendid fruit, heavy grains, and varied agricultural products will become widely famous.

GREAT AGRICULTURAL WEALTH.

"The next ten years," said a prominent official of the Government Reclamation Service, in speaking of the great present and coming development of the far northwest, "will see Montana lead all the Western States in the area of her irrigated land. Its agricultural future is assured and brilliant. It has the land and it has the water—all that are needed in the arid region to produce fabulous wealth."

out of their mountain fastnesses—the Absaroka, the Snowy, the Big Horn, and the Wind River ranges—where, at elevations of eight and ten and eleven thousand feet, the snows are perpetual melting under the summer suns and furnishing a constant water supply, especially in the late summer, when it is most needed for irrigation.

Much has already been accomplished by coöperative effort in irrigation among farmers. The irrigated area, according to the census figures, has increased



A FRUIT FARM IN THE BITTER ROOT VALLEY, MONTANA ; THE RESULT OF IRRIGATION.

Montana has an area equal to that of France. It has often been stated by various authorities, with all its great water supply conserved and made to irrigate its rich lands, within its boundaries there will be room for as dense a population as that of France.

Over three-fifths of this great state is drained by the Missouri River and its tributaries, the Yellowstone, the Jefferson, Milk River, and other branches. Strong rivers these are, rushing down

during the past two years at the rate of about 100,000 acres a year, and now aggregates 1,140,000 acres. This has been accomplished by the coöperation of small communities, and some of the most successful examples are seen at such places as Hinsdale and Chinook, in the Great Milk River Valley, where farmers have combined, taking up land under the five-year homestead law and constructing their own irrigation works, thus owning the land and the water

and paying no rent or tribute to water companies or water bondholders.

SMALL COST OF IRRIGATED HOMES.

Most of these works have been simple diversion propositions without expensive dams and the cost has been very light, land reclamations averaging, according to the 1900 census, but \$4.92 per acre. The opportunities are legion where bands of twenty or forty or one hundred enterprising farmers with a little money and with their strong arms and good teams may build diversion or storage dams and lead the water out upon 160-acre homestead claims, building up homes upon the desert which will make each and every one of them prosperous. The great productivity of Montana's lands is shown by the census figures. The total amount invested in ditches in Montana up to June 1, 1900, was \$4,683,073, while the total value of irrigation products for the one year, 1899, was \$7,230,042.

At the rate of increase in farming and irrigation in the state during the last census decade, the next ten years will see Montana's cultivated area trebled, if not quadrupled, even leaving out of consideration the vast reclamation works proposed by the federal government under the national irrigation law.

CHANGING THE COURSE OF NATURE.

The project for storing the flood waters of the Milk River in northern Montana, under the direction of District Engineer Cyrus C. Babb, of the U. S. Reclamation Service, is one of the first great works investigated by the government engineers, even before the passage of the national irrigation act. This involves huge dams and canals, and will reclaim, when carried to full completion, a very large area—probably half a million acres—of exceedingly rich land in the already famous Milk River Valley. It will be a famous engineering exploit, by which the water now flowing into the Saskatchewan, and thence into Hudson Bay, will be carried into the Missouri Basin and ultimately reach the Gulf of Mexico. The government has also taken up the Fort Buford project in eastern Montana and North Dakota, and is likewise preparing to spend \$2,500,000 in the Wyoming-Shoshone project, which

will reclaim some of the lands of southern Montana. These are the most advanced of the government works. In various other parts of the state the national hydrographers are making reconnoissances and surveys, investigating reservoir sites and reclaimable areas.

A serious menace, however, to the agricultural future of the state lies in the tendency to land absorption into immense private holdings, which have resulted largely through the abuse of the desert-land act and the commuters' clause of the homestead act, under which government land is entered by speculators and dummies and not by actual settlers. W. W. Wooldridge, president of the Montana Fruit Growers' Association, in a recent address cited 11 great ranches in Montana with an average acreage each of 55,000 and showed statistically the greater benefit which would have come to the state had these been settled up into several thousand small farms and occupied by settlers and their families. There seems to be a strong sentiment throughout the state for the repeal of these laws, leaving only the original homestead law, which has worked so successfully in building up coöperative irrigation colonies in the Milk River Valley.

IRRIGATION INCREASES MINING.

All of this great promise of agriculture will, however, but add to Montana's fame as a mining state. "Speaking from a miner's standpoint," said the Geological Survey official quoted above, "Montana's surface has been but indifferently scratched. We know that whole mountains exist of ore too expensive to work because the cost of living for man and beast is too high. The state has thousands of other mountains of which we know little or nothing. Montana is a vast country of itself; the mountains of its western half cover thousands and tens of thousands of square miles. Now, if we extend agriculture throughout the state, lead the great streams out of their deep channels and spread them over some millions of acres of arid soil, and this mountain wealth can be turned to man's account, railroads will penetrate the desert, and Montana can almost supply the world with the metals."

WORK OF BUREAU OF FORESTRY.

FIELD PROGRAM FOR AUGUST, 1904, WITH
FULL LIST OF PERSONAL ASSIGNMENTS.

ASCHEDULE of field work and assignments in the Bureau of Forestry is being issued monthly during the field season in order to keep the various members of the Bureau more closely in touch with the work as a whole and with each other. The growth of the forest movement, and especially of the government forest service, can in no way be more clearly shown than in the list of projects now under consideration by the Bureau of Forestry. For this reason its various lines of work and the men assigned to them are given in full here. It will be seen that the federal government is at the present time carrying on forest work of a varied nature in thirty-one states and territories.

ADMINISTRATION.

Gifford Pinchot, Forester, Brown Palace Hotel, Denver, Colo., August 3-5; Boise, Idaho, August 7, 8; return to Boise about August 13; return to Washington about September 7.

Overton W. Price, Associate Forester, Washington, D. C.

Geo. B. Sudworth, Chief of Dendrology, Washington, D. C., until August 20

Thomas H. Sherrard, Chief of Forest Management, Washington, D. C.

William L. Hall, Chief of Forest Extension, Washington, D. C.

F. E. Olmsted, inspection of field work.

E. T. Allen, Acting Chief of Section of Reserve Boundaries, Washington, D. C.

Hermann von Schrenk, Chief of Forest Products, Missouri Botanical Gardens, St. Louis, Mo.

ALABAMA.

Working plan for tract of Emmet O'Neal in northern Alabama, in coöperation with the owner, H. W. Chittenden.

ALASKA.

Examination of lands for forest reserves and additions to existing forest reserves, W. A. Langille.

ARKANSAS.

Experiments in seasoning of red and other inferior oaks, in charge of M. C. Jensen, Black Rock, Ark.; assistant, M. Smith, Jr.

CALIFORNIA.

Study of forest problems, in coöperation with the state, W. C. Hodge, Jr., in charge; headquarters, Occidental Hotel, San Francisco, Cal.; assistants, W. F. Hubbard, E. H. Hareford, P. D. Kelleter, C. G. Smith, A. R. Powers, A. E. Cohoon.

Study of sugar pine and western yellow pine, under direction of A. W. Cooper; assistants, W. J. Wade, R. H. Allen, W. L. Porterfield, G. J. Traugott, B. J. Teasdale, R. R. Secrest, G. H. Cecil.

Study of tanbark oak on Pacific coast, Prof. W. L. Jepson; permanent address, Berkeley, Cal.

Special studies of California trees, four-leaf pine (*Pinus quadrifolia*), Torrey pine (*Pinus torreyana*), bishoppine (*Pinus muricata*), Prof. W. R. Dudley; permanent address, Stanford University, Cal.

Study of native and exotic acacias, Prof. A. V. Stubenrauch; permanent address, Berkeley, Cal.

Coöperative planting plan for Griffith Park, in charge of G. B. Lull, Hollenbeck Hotel, Los Angeles, Cal.; assistants, H. O. Stabler, C. H. Sellers, T. C. Zschokke.

Work on the government nursery, San Gabriel Forest Reserve, under direction of T. P. Lukens, Pasadena, Cal.; assistants, A. T. Searle, W. F. Sherfese.

Study of chaparral, Santa Barbara Forest Reserve and Southern Sierras, direction of L. C. Miller, Hollenbeck Hotel, Los Angeles, Cal.; assistant, W. R. Mattoon.

Study of forest reproduction, southern Sierras, in charge of J. D. Guthrie, Santa Barbara, Cal.; assistant, S. J. Flintham.

Study of forest fires and methods of prevention, northern California, in co-

operation with the State, E. A. Sterling, Occidental Hotel, San Francisco, Cal.

Timber tests on red fir and Western hemlock, in coöperation with the University of California, Prof. L. E. Hunt, Berkeley, Cal.; assistant, R. Thelen.

COLORADO.

Establishment of forest nurseries, Pike's Peak Forest Reserve, under direction of Clyde Leavitt, Rosemont, Colo.; assistant, T. J. Taylor.

CONNECTICUT.

Timber tests, with special reference to the influence of moisture on strength of Southern pines, in coöperation with Yale University, Prof. J. W. Toumey and H. D. Tiemann, Yale Forest School, New Haven, Conn.; assistant, C. Barry.

DISTRICT OF COLUMBIA.

Timber tests, with special reference to rates of growth of Southern pines, H. S. Betts, Washington, D. C.; assistant, P. Hubbard.

Study of germination of pine seeds, in coöperation with Seed Laboratory at Washington, D. C., and on Dismal River Reserve, J. C. Blumer; address, Bureau of Forestry, Washington, D. C.

Tabulation and preparation of wood preservation, data from U. S. Census reports and from field, C. G. Crawford, Washington, D. C.

GEORGIA.

Improved methods of turpentine orcharding, experimental pine forests (orchards), secured by coöperation with Powell, Bullard & Company, Frank Klarpp, Ocilla, Ga.; assistant, S. P. Woolfolk.

HAWAII.

Examination of lands for insular forest reserves, R. S. Hosmer, Honolulu, Hawaii.

IDAHO.

Working plan for Northern Pacific Railway Company in Idaho, in coöperation with the company, under direction of A. K. Chittenden, St. Maries, Kootenai Co., Idaho; assistants, G. M. Homans, K. W. Woodward.

Preparation of forest map of Idaho, Smith Riley, Kooskia, Idaho; assistants, G. E. Tower, W. T. Cox.

ILLINOIS.

Study of the results of forest planting, central Illinois, R. S. Kellogg, Roodhouse, Ill.; assistants, H. M. Hale, J. M. Nelson, Jr., M. B. Pratt, F. J. Phillips, E. A. Ziegler.

INDIANA.

Timber testing at Lafayette, Ind., in coöperation with Purdue University, Dr. W. K. Hatt, Lafayette, Ind.; assistant, C. H. Hall.

IOWA.

Study of results of forest planting and preparation of planting plans, in coöperation with landowners, H. P. Baker, Ames, Iowa.

KANSAS.

Preparation of planting plans, in coöperation with landowners, Z. L. Bliss (also in Nebraska).

KENTUCKY.

Working plan for Hillman Land and Iron Company in western Kentucky, in coöperation with owners, directed by A. B. Patterson, Eddyville, Ky.; assistants, W. H. von Bayer, A. C. Ringland, J. E. Barton, J. H. Hausenvald, W. J. Morrill, T. L. Hoover, J. B. Anderson.

MAINE.

Study of fire prevention and control, in coöperation with the state, S. N. Spring, Orono, Me.; assistants, L. Margolin, E. R. Hodson, J. H. Ramskill, P. T. Harris.

MINNESOTA.

Inspection of lumbering, marking of timber, and forest measurements upon lands to become the Minnesota National Forest Reserve, under direction of E. S. Bruce, Cass Lake, Minn.; assistants, G. E. Marshall, W. E. La Fountain, R. G. Giffin, W. R. McKinnon, M. Burns, W. Wallace, J. S. Baird.

MISSOURI.

Louisiana Purchase Exposition, St.

Louis, exhibit of Bureau of Forestry, Alfred Gaskill, Forest, Fish, and Game Building, World's Fair, St. Louis.

Study of methods of wood preservation, Louisiana Purchase Exposition, St. Louis, in coöperation with various railroads, G. E. Clement, Missouri Botanical Gardens, St. Louis, Mo.; assistant, R. W. Ayres.

Special timber tests, Louisiana Purchase Exposition, in coöperation with various railroads, Dr. W. K. Hatt; headquarters, Purdue University, Lafayette, Ind.; assistants, H. D. Hartley, G. W. Noyes, and M. Cline, Missouri Botanical Gardens, St. Louis, Mo.

Chemical experiments, with special reference to wood preservation and moisture contents of wood, St. Louis, E. B. Fulks, Missouri Botanical Gardens, St. Louis, Mo.

MONTANA.

Study of western yellow pine, S. J. Record; assistants, M. Rothkugel, J. F. Bond.

NEBRASKA.

Work on Government nursery, Dismal River Forest Reserve, C. A. Scott, Halsey, Nebr.; assistants, F. W. Besley, W. H. Mast, F. B. H. Brown, E. C. Clifford, H. C. Neel, A. E. Oman, T. D. Woodbury.

Study of results of forest planting, eastern Nebraska, F. G. Miller, station A, Lincoln, Nebr.; assistants, L. M. Goodding, W. I. Hutchinson, G. W. Peavy, J. D. Warner, L. L. White.

Study of forest replacement in Nebraska, Dr. Chas. E. Bessey, Lincoln, Nebr.

NEW HAMPSHIRE.

Working plan for Ansel Dickinson estate in southern New Hampshire, in coöperation with the owner, C. A. Lyford, Ashuelot, N. H.; assistants, W. B. Piper, A. T. Boisen.

NEW MEXICO.

Seasoning and treating experiments and tests of special forms of ties, in coöperation with Southern Pacific and Santa Fé Railroads, H. A. Paul, Las Vegas, N. M.; assistant, F. Dunlap.

NEW YORK.

Execution of working plan for U. S. Military Academy, West Point, N. Y., in coöperation with the War Department, R. L. Marston; permanent address, 270 Crown street, New Haven, Conn.

Seasoning experiments on maple, beech, and birch cross-ties, with special reference to different methods of piling, in coöperation with New York Central Railroad, W. R. Wheaton, Utica, N. Y.

Preparation of report on European nursery methods, W. F. Fox, Albany, N. Y.

NORTH CAROLINA.

Seasoning experiments on juniper poles, with special attention to effect of rafting, in coöperation with American Telegraph and Telephone Company, D. G. Kinney, Wilmington, N. C.; assistant, J. Appleton.

SOUTH DAKOTA.

Commercial tree study of western yellow pine in South Dakota, H. M. Curran; assistants, J. E. Keach, F. L. Pray, C. L. Hill, F. M. Patton, E. G. Cheyney.

Study of results of forest planting, Sioux Falls to Brookings, J. M. Fetherolf, Sioux Falls, S. Dak.; assistants, J. P. Wentling, H. B. Holroyd, S. G. Smith, O. T. Swan, L. von Wernstedt.

Inspection of field-work, G. L. Clothier (also in Illinois and Nebraska, and preparation of planting plans in Oregon).

TEXAS.

Working plan and planting plan for New York and Texas Land and Cattle Company, in western Texas, in coöperation with the company, H. H. Chapman, Amarilla, Tex.; party from forest extension, J. Fred Baker, W. B. Hadley, A. S. Peck.

Investigation of different methods of piling and laying ties and tests of special forms of ties, in coöperation with Southern Pacific and Santa Fé Railroads, F. Tompkins, Somerville, Tex.

Tie seasoning experiments, in coöperation with the Southern Pacific and

Santa Fé Railroads, H. J. Brown, Silsbee, Tex.; assistant, C. E. Feagin.

Study of forest conditions of the Big Thicket country, Prof. W. L. Bray, Austin, Tex.

UTAH.

Study of forest reproduction preparatory to forest planting, Salt Lake Forest Reserve, A. F. Hawes, Salt Lake City, Utah; assistant, C. D. Mell.

WASHINGTON.

Working plan for Weyerhaeuser Timber Company in Washington, in coöperation with the company, C. S. Chapman, care Weyerhaeuser Timber Company, Tacoma, Wash.; assistant, H. D. Everett.

WEST VIRGINIA.

Working plan for United States Coal and Oil Company in West Virginia, in coöperation with the company, R. C. Hawley, Holden, W. Va.; assistants, C. H. Farnum, A. O. Waha, F. A. Silcox, J. B. Dumont, C. A. Mathewson, C. J. Buck.

WISCONSIN.

Study of forest conditions, in coöperation with the state, E. M. Griffith, Madison, Wis.; assistant, R. F. Nash.

WYOMING.

Study of lodge-pole pine, P. G. Redington.

REGIONAL STUDIES.

NEW ENGLAND.

Preparation of planting plans, in coöperation with land-owners (also in Ohio Valley), S. B. Detwiler.

EASTERN STATES.

Location and measurements of permanent sample plots, Prof. H. S. Graves, Milford, Pa.; New Haven, Conn.; assistant, G. H. Myers.

SOUTHERN APPALACHIANS.

Studies of Southern hardwoods, Walter Mulford, in Tennessee; assistants, W. B. Greeley, preliminary examinations in Tennessee; H. D. Foster, preliminary examinations in North Carolina; H. G. Merrill, with working-plan party on tract of United States Coal and Oil Company in West Virginia; J. S. Holmes, commercial tree study at Townsend, Tenn.; D. Skeels, T. A. Casey, J. R. Weir, J. E. Gow, H. D. Burrall, W. H. Kempfer, J. E. Lagdameo.

MIDDLE WEST.

Study of second growth, R. G. Zon. Woodlot examinations, W. G. Weigle.

WESTERN STATES.

Seasoning and treating experiments in Washington, Wyoming, New Mexico, and Texas, in coöperation with the Northern Pacific, Southern Pacific, and Santa Fé Railroads, R. P. Imes; headquarters, Missouri Botanical Garden, St. Louis, Mo.

Tie-seasoning experiments on lodge-pole pine and western hemlock, Sheridan, Wyo., and Tacoma, Wash., in coöperation with Northern Pacific Railroad, H. B. Eastman.

Examination of lands for new forest reserves, additions to existing forest reserves, and releases of reserved lands:

Inspection of field-work, Henry Grinnell.

In Montana and Wyoming, Coert Du Bois; assistants, Elers Koch, J. H. Hatton, W. H. B. Kent.

In Colorado, Utah, New Mexico, and Arizona, R. E. Benedict; assistant, R. V. R. Reynolds.

In Washington, Oregon, and California, H. J. Tompkins; assistants, R. B. Wilson, F. W. Reed.

Study of forest grazing, A. F. Potter.



FLOODS OF 1903.

DATA COLLECTED ON THE UNUSUALLY DESTRUCTIVE FRESHETS OF
LAST YEAR, WITH SUGGESTIONS LOOKING TO RELIEF IN FUTURE.

THE year 1903 had perhaps more than its fair share of natural calamity—of flood and fire and famine. In the United States during May and June there were three notable floods which caused serious loss of life and great destruction of property, one in Oregon, one in South Carolina, and one in Kansas. A recent publication of the United States Geological Survey, scheduled as Water Supply and Irrigation Paper No. 96, contains a discussion of the various phenomena connected with these floods, and suggests means for minimizing the destructiveness of future deluges. The author of the paper is Mr. E. C. Murphy.

The flood of shortest duration occurred on Willow Creek, Morrow county, Oregon, Sunday evening, June 14, 1903. It was the result of what is popularly called a cloudburst, a heavy rainstorm of short duration covering a very small area and peculiar to arid regions. The flood that rose as the result of the heavy downpour of rain lasted less than an hour, but in that short space of time one section of Heppner, a town with a population of about 1,400, was swept entirely away, a quarter million dollars' worth of property was destroyed, and more than 200 people were drowned. The great loss of life was partly due to the peculiar construction of the houses in Heppner. Nearly all these houses were built on posts of wood or stone, from which the flood lifted them and carried them away to be dashed to pieces against trees and other obstructions.

The South Carolina flood occurred on June 6, 1903, and continued for nearly twenty-four hours. In that time there was a rainfall of from $3\frac{1}{2}$ to 5 inches over an area of about 2,500 square miles on the southern slope of the Blue Ridge-Saluda Mountains, including parts of Cherokee, Spartanburg, and Pickens counties, in South Carolina, and Rutherford, Polk, and Henderson counties, in North Carolina. This area is drained by three small tributaries of Broad River,

known as the Pacolet, Tiger, and Enoree. The principal damage wrought by the flood was on the Pacolet, where numerous cotton mills were ruined and much railway property was destroyed.

The Kansas flood occurred during the last week of May and the first week of June. It affected a much larger area than either the Heppner or South Carolina flood and was due to a storm that lasted nearly a week.

The United States Geological Survey has fortunately six gaging stations in the watershed of the Kansas River, and has, therefore, a comprehensive record of the surface fluctuations of the river and its principal tributaries during the flood. The records at Lawrence and Lecompton, on the Kansas River, cover a period of 22 years. The estimated flow of the Kansas River on May 31 was 225,400 cubic feet per second. In other words, if there had been a storage reservoir 1 acre in area and $7\frac{1}{2}$ feet in depth on each section of the whole drainage area of the Kansas River, the water flowing into the river on May 31 was sufficient to have more than filled all of them.

The whole river bottom was flooded, crops were destroyed, stock was drowned, wooden buildings were lifted from their foundations and brick houses crumbled and fell, railroads were undermined, and bridges were swept away. Traffic in eastern Kansas was almost entirely suspended for two weeks. The property loss in Kansas and in Kansas City, Missouri, is estimated to have been no less than \$22,000,000.

Among the subjects considered in this paper are the effects of ground storage, of cultivation, and of forests in reducing the magnitude of floods. The effect on streams of dams, of bridge piers, and abutments is discussed; also the danger of building out into streams, thus narrowing the waterway and increasing the magnitude of floods. The relief afforded by straightening the channel is mentioned and the use of levees is explained.

THE ROSWELL ARTESIAN BASIN.

DATA CONCERNING A VALUABLE ARTESIAN
BASIN IN THE PECOS VALLEY IN NEW MEXICO.

AN investigation of this important artesian basin has just been completed by Mr. C. A. Fisher, a geologist of the U. S. Geological Survey. His report, giving a large amount of interesting and valuable data, will be issued by the Survey in the near future.

Location.—The Roswell artesian basin is located in the Pecos Valley, in south-eastern New Mexico. It occupies an area varying from 6 to 8 miles in width, and extending from a point a few miles north of Roswell, New Mexico, to near the mouth of Seven River, a distance of about 60 miles. The greater part of this area lies along the west side of Pecos River, the surface rising very gradually toward White and Sacramento mountains. The eastern limits of the basin are determined by moderately high bluffs, which follow the general course of the river throughout the entire length of the basin. The western margin is not indicated by any topographic feature, but flows are obtained on the gradual slope to an altitude equal to that of North Spring Lake, the apparent head of the Roswell artesian waters.

Character of Rocks.—The rocks of the district comprise limestone, sandstone, clays, and gypsum, which are believed to be of the Permian age. Overlying these deposits are extensive sheets of sand, gravel, and clay, laid down in successive terraces between the river and the high limestone slopes to the west. For convenience the Permian beds may be divided into three groups, the upper gypsum beds forming high bluffs on the east, the red sandy series which underlie the valley, and the massive limestones comprising the rugged slopes to the west. The beds have a uniform dip of about 4 degrees to the eastward. The gypsum series has an average thickness of about 300 feet, while the red sandy series immediately underneath reaches a thickness of about 600 feet in the south end of the basin. To

the north the thickness of the formation has been greatly reduced by erosion, especially in the vicinity of Roswell, where it scarcely exceeds 100 feet. The underlying massive limestones reach a very great thickness in this general region, but it is only the uppermost member, a porous, sandy limestone, with which we have to deal in the present consideration.

Distinct Horizons.—There are four or more distinct artesian water horizons occurring in the Permian beds of the Roswell basin. Three of them are found in the lower part of the red sandy series, while the fourth and strongest flow is in the porous sandy limestone.

Source of Supply.—These water-bearing formations outcrop in successive zones on the slopes to the west, where they receive their water supply by direct absorption from rainfall and the sinking of streams. The Hondo, Felix, and Penasco are the most important sources of supply in this area. These streams all rise high on the slopes of the El Capitan, White, and Sacramento mountains, where the annual rainfall is relatively large. As a result they carry an abundance of water in their upper courses, all of which sinks in the outcrop zone of the porous sandy limestone and the overlying sandy series, and passes underground to the eastward. After the water has entered these porous formations it is held down by impervious layers of limestone and clays, and under the lower lands eastward it is under considerable pressure.

Depth.—The flowing wells of this district vary from 50 to 800 feet in depth, the shallowest ones occurring in the low valley lands east of Roswell. To the south this main flow is reached at a much greater depth, due to the presence of beds belonging to the upper part of the red sandy series. In sinking an artesian well in the town of Roswell it is necessary to pass through

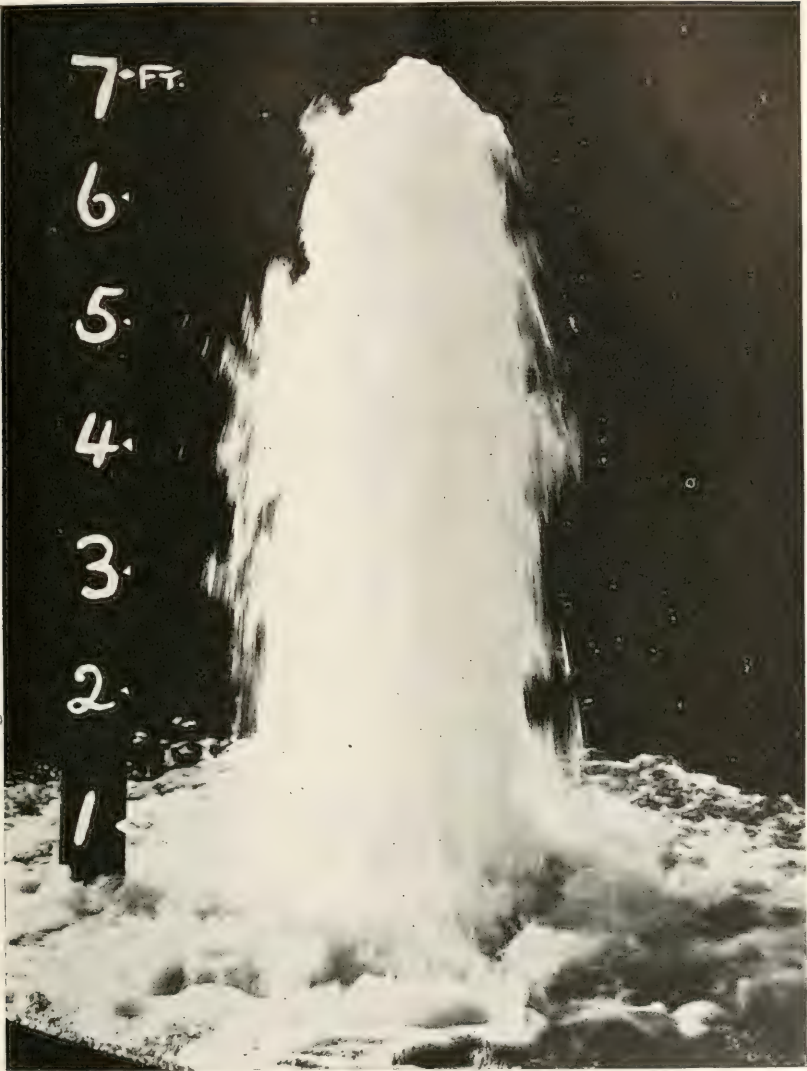


ARTESIAN WELL, NEAR ROSWELL, NEW MEXICO.

about 75 feet of alluvium, an equal thickness of red sandy clay, and to penetrate the porous sandy limestones to a depth of 70 to 80 feet before the main flow is obtained. In the region of Hagerman and Artesia the red sandy series is represented by about 600 feet of sediment, and as the overlying gravels are somewhat thicker, the total depth to the main flow is correspondingly deeper.

Pressure.—In the wells thus far examined the pressure varies from 8 to 80 pounds to the square inch. The number of pressure measurements which have been taken, however, are not great, and subsequent investigation may modify these figures. The strongest pressures are found in the vicinity of Artesia, where at present the greatest development in well boring is taking place. Some of the larger wells in this region have a flow of 1,700 gallons per minute, but the average flow is much less.

Decrease in Flow.—At the present time there are at least 40 well machines at work in the district, some of which are of the most improved type. Many new machines are also being brought in. As a result many wells are being completed each month. At present there appears to be no evidence of a decrease in flow, but it is feared that the multiplicity of wells may eventually lower the water plane, and provision



VIEW OF THE LARGEST ARTESIAN WELL, IN THE PECOS VALLEY, NEAR ARTESIA, NEW MEXICO. IT FLOWS OVER 3,000 GALLONS A MINUTE.

has recently been made for the systematic measurement of pressure each month of representative wells throughout the basin. In this way any diminution of the flow due to additional wells may be readily detected.

There is great need for the practice of greater economy on the part of water users of the Roswell artesian basin, and very few wells are provided with valves for shutting off the water when it is not in use.



FOREST FIRES IN MAINE.

THE BUREAU OF FORESTRY WILL
COÖPERATE WITH THE STATE IN A
STUDY OF THEIR CAUSES AND RE-
SULTS AND FOR THEIR PREVENTION.

LAST year Maine, like some other Eastern States, had the most disastrous fires in its history. A timberland area of more than a quarter million acres was burned over, entailing a loss beyond a million dollars. Drouth, unprecedented in severity, had prevailed from April 8 to June 9, and the forests were in a most inflammable condition. There were within sixty days 260 different fires in the burned-over districts. In strong contrast with the experience of New York in the Adirondacks, only three of these are positively known to have been of incendiary origin. Maine had just put into operation a new law amendatory of its forest fire warden service. But for the more efficient work done under this law, the fire loss would have been much greater.

To secure the information which may form the basis for protective measures against future losses on such a scale, and ascertain what can be done to repair the damage already suffered, the state authorities have arranged for a coöperative fire study of the Maine forests by the Bureau of Forestry of the U. S. Department of Agriculture. In accordance with its usual terms of coöperative work, the Bureau will share equally with the state the field expenses of this study. Five men have been assigned to it, and the work in the field will be prosecuted through the remainder of the summer.

The Bureau of Forestry fire study includes in its scope everything pertaining to the occurrence, results, prevention, and amelioration of the effects of forest fires in any region. The field force gathers from every responsible source evidence concerning the causes of the fires, the area burned over, and the damage done. Every statement of witnesses is verified, so far as possible, by personal investigation on the ground. It is ascertained whether anti-fire laws are respected or violated, and the attitude of

people in the neighborhood is learned—whether because of, or despite their occupations they dread and will fight fires, or whether they think them of little consequence, and perhaps rather wink at their occurrence; for local sentiment is the most powerful agency for causing or controlling forest fires. The fire risk to which capital invested in standing timber is exposed is at best under most conditions a very formidable hazard. It combines inflammability, exposure from camp fires, smudges, careless smokers and railroads, and scanty means of protection—all the qualities which insurance companies avoid in other risks. With the local population indifferent or hostile, the preservation of the forest is almost hopeless. The agents of the Bureau of Forestry are generally most efficient missionaries wherever they go, arousing the people with whom they come in contact to the interest of the community in preventing and putting out fires. From the data which they obtain advice is given as to enactment of more stringent laws, patrol regulations, and methods of fire-fighting.

The results following forest fires are studied to determine whether or not burned-over lands can be made again to produce a forest crop. The first inquiry here is, How badly has the forest been injured? If only the young growth has been killed, the problem is very different from that presented when the ground is swept clean of forest. In the former case, if there are enough seed-bearing trees left, nature requires only protection while she does her work of reforestation. But if the ground has been clean swept, she must be materially assisted if proper forest conditions and growth are to be reëstablished within any reasonable space of time.

The field party in Maine will first investigate the extent of damage which fire has done to the forests. Next it

will examine as to the existence of any natural reproduction of the original forest. Since the worst fires were only a year ago, little in the way of reproduction may be expected in the areas burned over; but what does appear will be carefully noted, and areas in the same district, burned over two, three, four, five, and more years ago, will be compared with each other and with the one-year-old burns. This work is done by taking sample strip acres, laying them off so as to get the best general average of the territory, and then counting all the seedlings and measuring all the trees on these strips. The different kinds of trees encountered and the varying forest conditions, as of soil, etc., are also recorded. In this way an estimate can be formed of how fast natural reproduction takes place.

When this work has been finished the problem remains how to get back a good, dense, normal-growing forest. This is accomplished in one of two ways. The first plan is adopted when the stand of trees is found to be open, scraggy, and in bunches, and consists in helping nature by protecting against fire and stock as perfectly as possible. In addition, the soil may be stirred to aid natural seeding, and, finally, seeds may be scattered on bare spots. The second plan is

used where the ground has been swept clean by fire and natural reproduction is almost out of the question. In that case the only resource is tree planting. This is a special branch of the work of the Bureau, and one in which great success has been achieved.

Since nearly all of the timberland of Maine is under private ownership, the results of the study must find their principal application in recommendations to individual landowners. But as the Bureau and the state are coöperating in the study, whatever recommendations are made will have added to their scientific value the weight of state interest and approval.

Unless burned-over areas are thus protected and encouraged, forest deterioration is inevitable. An inferior species of tree will usurp the ground and postpone for years, if not forever, a reproduction of the original forest. So that forest fires not only mean immediate and present financial loss in the destruction of timber and young growth, but they also so alter conditions that inferior grades of forest take the place of better growth. It is to escape this double evil that Maine has secured the assistance of the Bureau of Forestry in the coöperative fire study which is now about to begin in earnest.

THE BILTMORE MEASURING STICK.

BY

T. F. PEVEAR.

THERE has recently been brought into use at Biltmore a rather ingenious contrivance for the purpose of measuring the diameters of trees. It consists of a straight stick or ordinary walking cane, upon which are marked off certain ratios corresponding to different diameters, so that by holding the stick horizontally at arm's length against the tree, and sighting toward either side of the tree one can read the diameter directly from the stick. The invention is due to Dr. C. A. Schenck, forester to

the Biltmore estate, and the stick has been given a thorough trial, with very good practical results, by the students of the Biltmore Forest School.

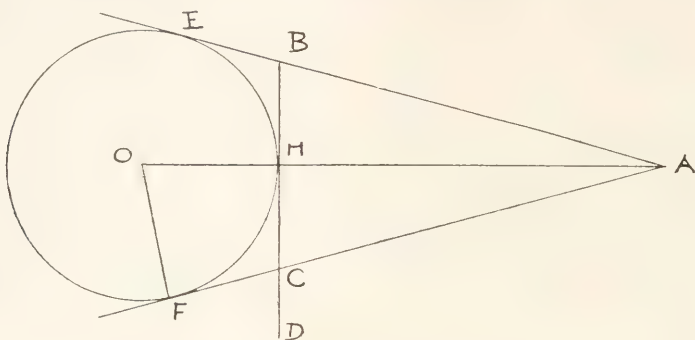
One of the simplest explanations of the mathematical principles involved in the application of the measuring stick is as follows:

In the following figure, suppose A F and A E to be the lines of vision when sighting to either side of the tree, which is represented by the circle whose center is O. B D represent the measuring

stick held horizontally against the tree at arm's length, A H. The lines of vision are tangents to the circle and cut the measuring stick, B D, at B and C, respectively.

To construct the measuring stick for certain diameters:

A H, being the length of the outstretched arm, is known.



O F and O H, being radii of the circle and equal to one-half of the given diameter, are known.

\therefore A O, being equal to A H + O H, is known, and in the right-angled triangle, A F O

$$A F = \sqrt{A O^2 - O F^2}$$

Since the right triangles A H C and A F O are similar,

$$H C : O F :: A H : A F, \quad \frac{O F \times A H}{\sqrt{A O^2 - O F^2}}$$

or $H C =$

and $B C = 2 H C$.

When the length, B C, is found, it is measured off on the stick, and the corresponding diameter is written at the point C. In like manner, the ratios are found for other diameters and marked upon the measuring stick. It is obvious that the ratios will differ as arms differ in length, so that the same stick could not be used by every one, but the sim-

plicity of the invention commends it, because a measuring stick that will give good practical results may be easily constructed within ten minutes to fit any length of arm.

Another idea of the inventor is to apply the principle to the helve of an axe, marking off the ratios as on the measuring stick, so that the axe would be useful, not only in marking and felling trees, but also have the added value of being of decided use in measuring their diameters to estimate their contents.

IRRIGATION FOR THE INDIANS.

STUDY OF CONDITIONS IN THE GILA VALLEY — UNDERGROUND WATER SUPPLIES TO SUPPLY PRESENT DEFICIENCY.

THE underground waters of Gila Valley, Arizona, have been recently investigated by Mr. Willis T. Lee, of the United States Geological Survey. The object of the investigation was to ascertain the amount of water available for irrigating the lands of the Indians in this valley. The greater part of the valley is included in the Pima Indian Reservation, on

which there are about 7,870 Indians. They are an intelligent, industrious people, and until 1890 they were prosperous. From time immemorial their irrigation canals had been supplied with water from the Gila, but since 1890 the diversion of the Gila waters above the reservation by white settlers has caused a shortage of water. The result is that the area of lands cultivated by the In-

dians has decreased from 14,000 to 7,000 acres and the Pimas and Maricopas of this valley are now impoverished.

To find a remedy for this shortage of surface waters Mr. Lee has carefully studied the geographic relations and geologic conditions of the Gila Valley. He finds evidence that there is an amount of underground water in this region sufficient to saturate the valley soil and still give an overflow of 2,000 inches. This water is probably due to the junction of three underflows—those of Gila, Santa Cruz, and Salt rivers. These are fed from at least three sources—rainfall in the valley, springs from the hillsides, and various streams that enter the valley from the hills, the most important of which is the Gila itself. The quantity of waters held in the gravels at any one time within easy reach of pumps, is estimated at from 1,120,000 to 1,960,000 acre-feet. It is calculated that 40,000 acre-feet of water a year will supply all the present needs of the Indians on the reservation. If the computations are correct, there is now accessible enough water to supply the Indians for at least twenty-eight years. The chemical character of these waters of the underflow is fortunately favorable to their use in irrigation.

Two means of making this water available for irrigation are in use—seepage ditches and pumping plants. Where seepage ditches have been tried the results are disappointing. The quantity of water actually obtained falls far short of expectations; the cost of con-

structing and maintaining a deep ditch in the loose gravels and quicksands is large compared with the amount of water obtained, and at best only the uppermost part of the underflow is penetrated. On the other hand, Mr. Lee believes that sufficient water can be drawn from the underflow of the Gila Valley by means of pumping to supply the needs of the Indians and also materially to extend the cultivated area without exhausting the available supply. He estimates that ten plants of a capacity similar to that of the one now under construction at Sacaton will supply the required 40,000 acre-feet a year and allow 36 per cent of the time for stoppage and repairs. Taking the cost of the pumping plants in the Salt River Valley as a criterion, Mr. Lee finds that money spent in the construction of such plants will be safely and profitably invested.

One of the most interesting phases of Mr. Lee's investigation is that on the economic conditions of the Indians. Though peaceful, honest, and industrious, they are lacking in executive ability. They are, however, easily managed and are prosperous when wisely directed. When left to their own devices, they do not properly appreciate or utilize their advantages. At the western half of the reservation their most imperative need is adequate supervision. Their needs at the eastern half are, first, a water supply; second, supervision. It is Mr. Lee's opinion that a water supply without supervision would be unwise.

EXPERIMENTAL FOREST IN MINNESOTA.

BY

GENERAL C. C. ANDREWS,

CHIEF FIRE WARDEN OF MINNESOTA.

AN act of Congress at its last session authorized the State of Minnesota, through its state land commissioner and state forestry board, to select 20,000 acres of third or fourth rate land for experimental forestry purposes, and the selec-

tion has been made on the Vermillion range, in townships 64, range 13, and 63, range 13, distant about 12 miles west and northwest of Ely. It is a rugged forest region in a fine lake setting. Most of the surface is underlaid with granite,

upon which the soil is thin. There are hills rising 80 feet above the lakes, making a beautiful landscape. A few elevated areas are almost bare, light-colored granite, but upon which, in the middle of July, was found an abundance of blueberries. In low places the black alder is frequent and there are some swamps of dwarf spruce. In one of these a spruce with a diameter of only one and a half inches was cut showing forty-two rings, thus indicating it was as many years old.

As a whole, the lands are densely covered with thrifty forests from 10 to 30 years of age, of which the prevailing kind is jack pine, though there are groups, though not extensive, of Norway and white pine; and good specimens of both Norway and white pine of merchantable size are found scattered through the woods. Wherever there is a bit of good loamy soil the young white pine is trying to effect a lodgment. Poplar and white birch are frequent, and on the lower lands are spruce and tamarack of considerable value.

Along the lake shores and principal streams the moose and deer have made a trail, which helps the woodman in his progress. There are abundant evidences of wild game. We saw, however, but one moose, who appeared on the lake shore within a hundred yards of our camp at breakfast time.

Within or adjoining these forest-reserve lands are twenty-one lakes, generally deep, and with wooded, rock-bound shores. One of these, locally known as Crab Lake, is noted for its black bass. Some of the land borders the north end of Burntside Lake, which is 8 miles long by 3 or 4 miles wide at its widest place,

has many handsome islands, on some of which are cottages of Ely people, and contains trout. Burntside Lake is probably the most beautiful lake in Minnesota. The late Alexander Winchell, of Michigan, said it surpassed in beauty of scenery the Thousand Islands of the St. Lawrence.

As the state's forest, fish, and game preserve this 20,000-acre tract will always afford valuable means of recreation for the public. One can visit these lands by boat all the way from Ely. Streams navigable for boats connect several of the lakes, and with moderate outlay water communication can be extended. It should not be very expensive getting the logs from this reserve to the sawmill at Winton. The most southerly part of the lands are not more than 3 or 4 miles from the Duluth and Iron Range Railroad at Robinson station.

What will be the first steps the state will take with these forestry lands? It will do just as a business man would do if he owned them. It will take pains to protect them from fire, which, in places where the soil lies thin on rocks, would destroy both timber and soil. It will, or should, have a careful survey made of the lands by competent foresters and a map and report made showing the kinds, amount, and value of the timber which should be marketed now and the amount that should be cut in ten and twenty years hence, the proper routes for roads and cost of building, and best ways of getting the timber to market; what portions, if any, of the lands should be artificially stocked with forest and with what kind, and what plan should be adopted for maintaining a sustained yield.

TWELFTH NATIONAL IRRIGATION CONGRESS.

WILL BE HELD AT EL PASO, TEXAS, NOVEMBER
15-18—SPECIAL HALL TO BE BUILT FOR ITS SES-
SIONS—ATTRACTIVE PROGRAM BEING ARRANGED.

THE committee of arrangements in charge of the Twelfth National Irrigation Congress announces that it will be held at El Paso, Texas, November 15, 16, 17, and 18. That the commit-

tee is making big preparations for the Congress is attested by the fact that at a recent meeting the contract was let for the construction of a convention hall capable of seating more than 3,000 peo-

ple. This hall will be completed by October 1, and will then be decorated and furnished in readiness for the session of the Congress.

A statement has just been issued showing that \$15,000 will be spent in working up the Congress and providing for entertaining the delegates attending it.

The officers of this Congress are Hon. W. A. Clark, of Montana, president; L. W. Shurtliff, of Ogden, Utah, first vice-president; W. C. Johnson, Denver, Colorado, second vice-president; John Hall, Lampasas Springs, Texas, third vice-president; H. B. Maxson, Reno, Nevada, secretary; C. B. Boothe, of Los Angeles, chairman of executive committee, and Guy E. Mitchell, of Washington, D. C., chairman of press committee.

In order to facilitate the preparations for the Congress and to insure a thoroughly interesting program and the attendance of prominent workers in every line of endeavor closely related to irrigation, the program has been divided into sections.

These sections are Forestry, Land and Water Laws, Irrigation Engineering and Mechanics, Production by Irrigation, and Climatology.

The section of Forestry is in charge

of Gifford Pinchot, Forester, United States Department of Agriculture; the section devoted to Land and Water Laws will be in charge of George H. Maxwell, executive chairman of The National Irrigation Association; Engineering and Mechanics, under direction of F. H. Newell, chief of the United States Reclamation Service; Climatology, Willis L. Moore, chief of the United States Weather Bureau, United States Department of Agriculture.

Committee on arrangements at El Paso for the Congress are Hon. W. W. Turney, chairman; Alfred Courchesne, J. R. Harper, Francisco Mallen, John W. Fisher, E. Kohlberg, E. C. Pew, Sr., and A. W. Gifford, secretary.

The entertainment of the visiting delegates to the Congress is being thoroughly planned by the people of El Paso. There will be a carload of fruits and wine for consumption by the delegates, a reception and ball, a barbecue smoker for the men, a bull fight in Juarez, Mexico, just across the Rio Grande River; a roping contest and broncho riding by cowboys, trip to El Paso smelter, the third largest in the United States; Indian sports by Mescalero, Apaches, and other tribes, and possibly a miners' drilling contest.

A VALUABLE PHILIPPINE CABINET WOOD.

A STRIKING DISPLAY OF NARRA WOOD IN THE
PHILIPPINE FOREST EXHIBIT AT ST. LOUIS.

BY

EBER C. SMITH.

A VISIT to the Forestry Building of the Philippine Exhibit at the St. Louis Exposition would be worth the while of any one attending the fair, and particularly those interested in lumbering and the fine-woods industry.

The gathering of this exhibit and the transportation of the same to St. Louis constituted one of the principal items of cost, which aggregated over a million dollars, nearly all of which was paid for out of the treasury of the civil

government of the Philippine Islands. Some idea can be formed of its extent and magnitude from the fact that it contains more than 650 different varieties of woods and weighs more than 2,500 tons.

The extensive forests of our new possessions have practically never been touched by the woodman's ax, and today furnishes an excellent opportunity for lumbermen to engage in a sure and lucrative business.

Upon entering the west end of the Forestry Building the visitor will at once be attracted by a highly polished board of narra wood, thirty-six feet long and five feet broad and four inches thick. From this beautiful and magnificent piece of wood one can form an idea of the magnitude of some of our Philippine woods. The narra belongs to the superior group, the male being rose color (from carnation to blood red) and the female white.

It is found on the islands of Luzon, Leyte, Masbate, Mindanao, Mindoro, Negros, Panay, Paragua, and Samar. They form practically virgin forests, the lumber made from this wood having in the past been but little shipped from the islands. It is extensively used throughout the archipelago for flooring by those financially able to obtain it, and also for furniture and housefurnishings. It is very durable and impervious to decay. It is the mahogany of the Philippines and is prettily marked, with a variety of shades, varying from straw-color to blood red, the former being the more common. It is a first-class wood for general purposes. The exhibit contains many other beautiful specimens of this wood. It resists a warm and wet climate and insects which are de-

structive to many other of the native woods.

It is estimated that a quantity and quality of narra to meet any reasonable demand can be delivered in the log on the beach for seven cents a cubic foot. It is worth in Manila \$1.15 a cubic foot and \$150 a thousand sawed into lumber.

Many handsome tables made of narra are distributed among the exhibit buildings at the Philippine reserve, the most notable being a round table over nine feet in diameter, being one solid piece of timber. It can be seen in the east wing of the Women's Building, designated "The Typical Manila Building." This wood has a very agreeable odor.

The white narra has a varying color, the most common being ochre yellow, with gray grain, which becomes darker in time, acquiring a grayish yellow, with intermediate tints from red color. The white narra, like the male member of the family, grows into large trees, which will square four feet, but more commonly two feet. Notwithstanding that it is of a more open grain than some of the other fine woods of the islands, it is susceptible of a fine polish, is well and prettily marked, and is in general use for the manufacturing of furniture.

RECLAMATION SURVEY IN NEBRASKA.

EARLY WORK INDICATES THAT FEASIBLE
PROJECTS ARE LIKELY TO BE FOUND.

THE report of the engineers who are carrying on investigations looking to reclamation in the valley of the North Platte in western Nebraska shows very satisfactory progress.

Near the Pathfinder dam-site test pits were sunk to ascertain if the foundation was such that a spillway could be built at that point. Granite was found in most of these pits at depths varying from 10 to 13 feet. The formation above the granite is a lime cemented gravel and lies directly on the granite with no intervening strata of other material.

A surveying party made a reconnaissance of the lands along the North

Platte River below Caspar, and between Bessemer and Muddy Creek some 5,000 acres of irrigable land were found. This work is being continued. Preliminary surveys were run from the sand-hills east toward Sheep Creek, and a number of routes through the sand-hills were also surveyed. For a great part of the distance the line passes through valleys in which the water will spread out, forming shallow pools, the largest being from 600 to 800 feet long by about 200 feet wide. The cuts through the ridges separating these valleys will not be deep, and the material, which is washed sand, may be sluiced out and deposited in the



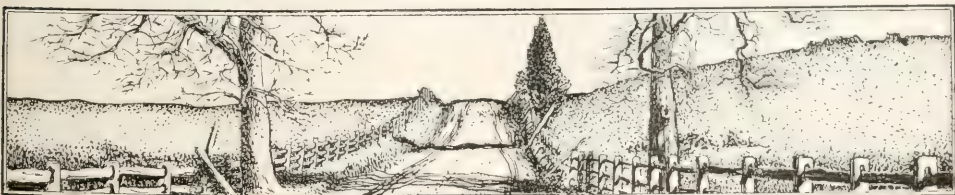
LOOKING DOWN THE NORTH PLATTE RIVER FROM THE NEBRASKA-WYOMING BOUNDARY.

next valley below. It was at first believed that the water spreading over so large an area as would be flooded would result in a great loss by seepage and evaporation, but the sediment carried by the canal would in time probably render these valleys nearly impervious.

Farther to the south the valleys are somewhat larger and have a less elevation than those along the line of the first survey. For 9 miles west of the state line the canal will run over a gently rolling country and the cuts in the ridges will not exceed 15 feet from the bottom of the ditch. After the 9 miles mentioned the canal line will encounter a series of gravel ridges in its approach to Rawhide Creek. Preliminary surveys are being made at this point.

A topographic party has been busy mapping the irrigable lands lying on the benches on the north side of the river. Of the $40\frac{1}{2}$ square miles mapped during the month of June, 9,000 acres were classified as first-class lands, 10,000 acres as second class, and 7,000 acres as worthless for cultivation. The 10,000 acres of second-class land as a rule lie well for irrigation, but have a sandy, light soil, like all the land on the benches near Sheep Creek.

These reports show that the canal is practicable, and indicate a feasible cost per acre for reclamation. The difficulties anticipated in getting through the sand-hills near the state line have not materialized, and but few unforeseen difficulties have been met.



THE WATER ELM.

BY

JENS JENSEN.

DURING the summer of 1903 I spent my vacation in that part of the State of Michigan which is generally known as the fruit belt. It was not the fruit industry that had attracted me there, but the sand dunes along the Michigan coast between St. Joseph and South Haven, with their interesting vegetation. The flora along the Black River was also carefully studied, and brought many surprises, being so different from that growing in the same latitude in Illinois. One of the special points of interest in the fruit district is the state experiment farms at South Haven, and it was here I was shown the water elm (*Zelkova acuminata*).

I will let Mr. Farrand, the superintendent in charge of the station, tell the history of the tree: "Seeds of the present trees were received by the late Hon. J. J. Lyon, a well-known horticulturist, in 1879, under the name of Skikiki, and said to be of Japanese origin. The largest one of the trees on the grounds was transplanted young; the other two were moved from another part of the grounds to their present place when quite large, and have never recovered from this transplanting."

The largest tree measured 3 feet 10 inches in circumference over one foot from the ground, and is over 20 feet in height. The trees are growing on level land a few hundred feet from Lake Michigan and about 30 feet above the water level of the lake.

The top soil is a black, sandy loam about 8 inches thick, with a layer of whitish sand to a depth of about 1 foot, and below this a heavy yellowish clay. I was greatly surprised at the presence of such beautiful and thrifty specimens of this *Zelkova* in Michigan; experience

had taught me that it was not hardy at Chicago, although it is farther to the south. It must be admitted here that climatic conditions are more favorable to vegetation on the Michigan side of Lake Michigan than on the Illinois side.

As Mr. Farrand states, the seed was sown in 1879, which made the trees 24 years old when I saw them in 1903. The growth of the larger specimen during the 24 years is one of more than common interest, and gives room to the suggestion, What possibility has the water elm as a forest tree, where climatic and soil conditions are favorable to its growth?

That the larger tree at South Haven had ripened seeds was evident by the seedlings found in a quince hedge close to the tree. Mr. Farrand related that he had never paid much attention to the flowers and seeds, but remembered that it had been covered with small seed pods during the summer of 1902. The circumstances under which the seedlings had been able to germinate rather tends to a prolific reproduction under favorable conditions.

The great value of the lumber of this species for building material, its hardiness and fast growth, and the possibilities for reproduction should stimulate inquiries as to its practical value for forest planting.

As an ornamental tree, its value is not questioned. The smaller tree illustrates well how much trees suffer by being transplanted after years of growth—a habit so much in vogue among tree planters.

Zelkova acuminata is indigenous to the mountains of Japan; another species, *Zelkova crenata* (the Siberian elm), is a native of the Caucasus.

THE RECLAMATION OF ARIZONA.

HAS THE HEARTY APPROVAL OF GOVERNOR BRODIE, -
WHO MAKES VALUABLE SUGGESTIONS FOR THE WORK.

THE Honorable Alexander A. Brodie, governor of Arizona, is in hearty sympathy with the aims and purposes of the Reclamation Service. As chief officer of a commonwealth that embraces large tracts of arid land, he appreciates the benefits that will follow a system of scientific irrigation. In response to an invitation from the Director of the United States Geological Survey, he has recently made some pertinent suggestions in regard to the work of measuring streams and investigating the water resources of the territory for irrigation purposes.

Next to the Salt River dam, which is now in process of construction, Governor Brodie thinks that the Colorado River project is the most important. There is no greater area of irrigable land in the Southwest, he declares, than that along the Colorado River from above Needles to the Mexican border. The available land continues in vast stretches after the river has departed at Yuma for the sea. This river frequently overflows its banks and damages crops in the cultivated section about Yuma. It would, therefore, seem advisable to provide means for storing its flood waters. Governor Brodie also advocates the construction of a levee from the town of Yuma to the Mexican line to prevent the overflow of the river.

He suggests that the water supply of the Santa Cruz Valley be investigated,

that proper attention be given to the artesian belt in San Pedro Valley, and that the numerous small reservoir sites in different parts of the territory be exploited. He thinks it would be advisable to extend the surveys already begun to the upper stretches of the Salt and Gila rivers for the purpose of locating available reservoir sites on those streams and their tributaries. The same might also be said of the Little Colorado River, which takes its rise in the vicinity of the White Mountains, in the eastern part of Arizona. It is probable that on all these streams and their tributaries reservoir sites may be found where flood waters could be stored for use on lands in the valleys below. Subsidiary dams might be constructed in the upper tributaries of streams, and assistance thus rendered to those farmers who are struggling with uncertain water supplies.

Governor Brodie also thinks it advisable that surveys for the location of underground water supplies should be extended. These will be useful in furthering irrigation enterprises dependent on power-pumping plants.

In connection with Governor Brodie's suggestions, it is interesting to note the announcement of Mr. N. H. Darton, chief of the Survey's western division of hydrology, that provision will soon be made for a study of the waters in the Santa Cruz and San Pedro valleys.

RECENT PUBLICATIONS.

New England Ferns and Their Common Allies.
By HELEN EASTMAN. Illustrated. Published by Houghton, Mifflin & Co., Boston, Mass. \$1.25 net.

The ferns, always of interest to botanists, do not, however, come in for the share of critical study they should. This book by Miss Eastman should do a lot to spread a desire for more careful study of this interesting family of plants.

This volume is a guide to all the ferns of New England and some of their allies—club-mosses, horsetails, etc. It contains brief and untechnical descriptions of over sixty species or varieties of ferns, with eleven of the allies, and points out more distinguishing marks of difference between species resembling each other than are found in any other work. The illustrations, of which there are nearly fifty, are from direct prints of specimens on photo-

graphic paper and are absolutely accurate. It is believed that they will prove more helpful to beginners than any series of fern pictures that has heretofore appeared. The book is provided with an index and a glossary, and also tables listing the species fruiting in each month of the season and showing what species may be looked for in each particular kind of soil and environment.

The American Natural History. A foundation of useful knowledge of the higher animals of North America. By WILLIAM T. HORNADAY. 300 illustrations from photographs and original drawings. Numerous diagrams and maps. Over 400 pages, double column, 5½ by 8 inches. New York: Charles Scribner's Sons. \$3.50. Postage extra.

William Temple Hornaday, author of "The American Natural History," is the director of the New York Zoological Park. He has also to his credit several other volumes, including a "Guide to the New York Zoological Park," "Two Years in the Jungle," "Taxidermy and



W. T. HORNADAY, AUTHOR OF THE "AMERICAN NATURAL HISTORY."

Zoological Collecting," "Free Rum on the Congo," etc. The present book is the result of many years of study, research, and observation among the wild animals of this continent. It is written in a popular manner; in scope and arrangement it is scientific. The author has tried to make clear the place of each mammal, bird, reptile, amphibian, and fish in nature's system, and has clearly described his subjects. The book is written for the teacher, the student, and the general reader, and takes the place between the "nature book" and the zoology. The author relates here and there throughout the book anecdotes and personal experiences and observations. There are 200 original drawings by Beard, Rungius, and Sawyer; 100 photographic reproductions by San-

born, Keller, and Underwood, and numerous diagrams and maps. The greater number of the illustrations have been made expressly for the work, which is further provided with indices.

How to Make a Flower Garden. Manual of practical information and suggestions. Published by Doubleday, Page & Co., New York. Price, \$1.60 net. Illustrated.

It is doubtful if the amateur gardener can find more of profit in the reading of a single volume than is given in this handsome publication. It is made up of chapters by expert gardeners, including L. H. Bailey, Sarah Hopkins, Warren H. Manning, William Verbeck, and a score of others.

The book covers practically every branch of the subject, and there are many accounts of garden making in various sections of the country based upon actual experiences. The appendices alone, for the different lists of flowers and shrubs they contain suitable for all purposes and seasons, are worth more than the price of the volume to the average gardener. The illustrations, over one hundred half-tones in number, add much to the value of the book.

Baby Pathfinder to the Birds. By HARRIET E. RICHARDS and EMMA G. CUMMINGS, members of American Ornithologists' Union. Paper, 30 cents; leather, 50 cents. W. A. Butterfield, publisher, 59 Bromfield street, Boston.

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PUBLICATIONS RECEIVED.

U. S. Department of Agriculture, Weather Bureau, Bulletin M, "The Floods of the Spring of 1903 in the Mississippi Watershed." By H. C. Frankenfield. Washington: Government Printing Office, 1904.

U. S. Department of Agriculture, Weather Bureau, Bulletin No. 33, "Weather Folklore and Local Weather Signs." By Edward B. Garriott. Washington: Government Printing Office. Price, 35 cents.

Department of Agriculture, Kingdom of Belgium. "Agriculture: Agricultural Education." Printed by Charles Bulens, Brussels, for distribution at the World's Fair, St. Louis, 1904.

U. S. Department of the Interior, Geological Survey, Bulletin No. 230, "A Gazetteer of Delaware." By Henry Gannett. Washington: Government Printing Office, 1904.

DEPARTMENT OF THE INTERIOR, U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C., JULY 19, 1904. Sealed proposals, in duplicate, will be received until 2 o'clock p. m., August 25, 1904, at the office of D. W. Ross, Engineer U. S. Geological Survey, Boise, Idaho, for the furnishing of 14,000 barrels of Portland Cement at Minidoka, Idaho. Specifications, forms of proposal, and particulars may be obtained upon application to D. W. Ross, Boise, Idaho, and to the Chief Engineer, U. S. Geological Survey, Washington, D. C. Each bid must be accompanied by a certified check, payable to the order of the Secretary of the Interior, for two per cent of the contract price, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of 50 per cent of the contract price for the faithful performance of the work. The right is reserved to reject any and all bids, waive technical defects, and to accept one part and reject the other, as the interests of the service may require. Bidders are invited to be present. THOS. RYAN, *Acting Secretary*.

DEPARTMENT OF THE INTERIOR, WASHINGTON, D. C., JULY 13, 1904. Sealed proposals, in duplicate, will be received at the office of the United States Reclamation Service, Roswell, New Mexico, until 2 o'clock p. m., September 6, 1904, for the construction of one earthen dam, retaining embankments, spillways, gates, and pipe conduits, and 3½ miles of canal, for the purpose of conducting the flow of water of the Hondo River to a reservoir at a point 12 miles southwest from Roswell, New Mexico. Plans and specifications may be examined and forms of proposal obtained by application to the Chief Engineer of the Reclamation Service, Washington, D. C., or to W. M. Reed, Roswell, New Mexico. Each bid must be accompanied by certified check for 2 per cent of the amount of the bid, payable to the Secretary of the Interior, as a guaranty that the bidders will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of 20 per cent of the contract price for the faithful performance of the work. The right is reserved to reject any or all bids, to waive technical defects, and to accept one part of the bid and reject another, as the interest of the service may require. Bidders are invited to be present at the opening of bids. Proposals must be marked "Proposals for Reservoir, Canals, etc., Hondo River, New Mexico." THOS. RYAN, *Acting Secretary*.

DEPARTMENT OF THE INTERIOR, UNITED STATES GEOLOGICAL SURVEY, RECLAMATION SERVICE, WASHINGTON, D. C., JULY 29, 1904. Sealed proposals, in duplicate, will be received at the office of the U. S. Reclamation Service, at Montrose, Colorado, until 10 o'clock a. m., September 15, 1904, for the construction of about 15 miles of main distributing canals, involving about 700,000 cubic yds. of earthwork, for the conveyance and partial distribution of about 1,300 cubic feet of water per second from the mouth of the Gunnison Tunnel, near Cedar Creek station, to a point on the Uncompahgre River about 9 miles south of Montrose, Colorado. Bids will be received on excavation and embankment for one or more divisions which will approximate 50,000 cubic yards each. The right is reserved to award to one bidder as many or as few of such divisions as the interest of the service may require. Specifications, form of proposal, and plans may be inspected after August 10, 1904, at the office of the Chief Engineer of the Reclamation Service, Washington, D. C., at the office of the District Engineer, U. S. Reclamation Service, Chamber of Commerce Building, Denver, Colo., and at the office of the U. S. Reclamation Service, Montrose, Colo. Each bid must be accompanied by a certified check for 5 per cent of the amount of the bid, payable to the Secretary of the Interior, as a guaranty that the bidders will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of 50 per cent of the bid for the faithful performance of the work. The right is reserved to reject any or all bids, to waive technical defects, or to accept one part of a bid and reject another, as the interests of the service may require. Bidders are invited to be present. Proposals must be marked "Proposals for the construction of South Canal, Uncompahgre Valley Project." THOS. RYAN, *Acting Secretary*.

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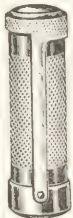
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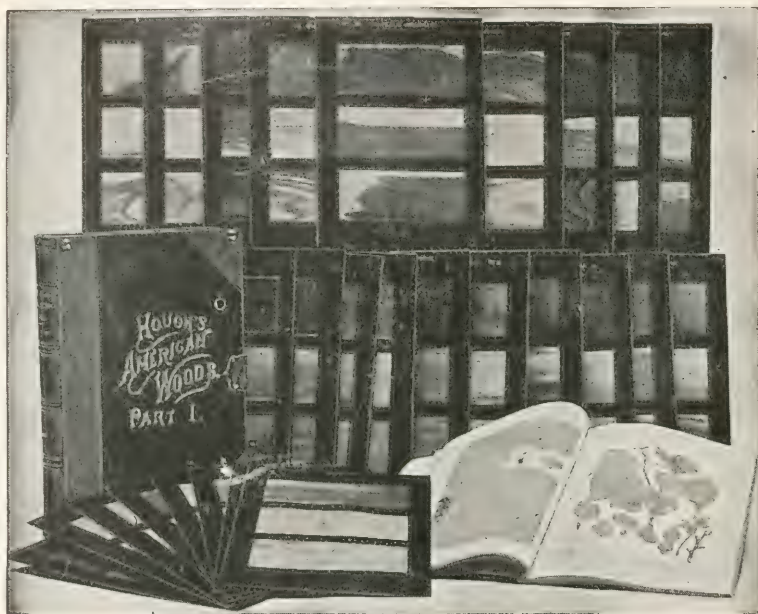
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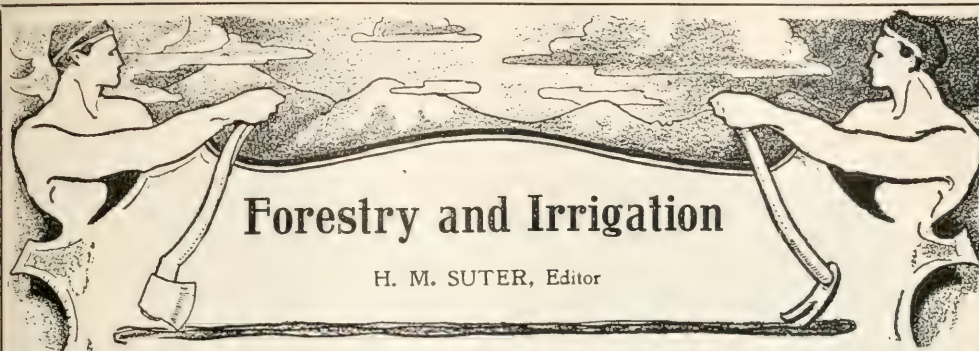
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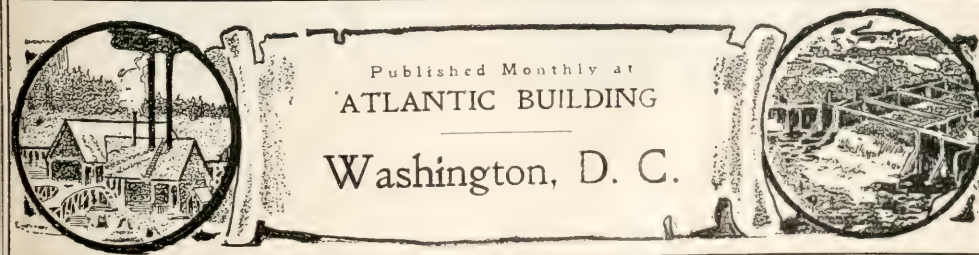
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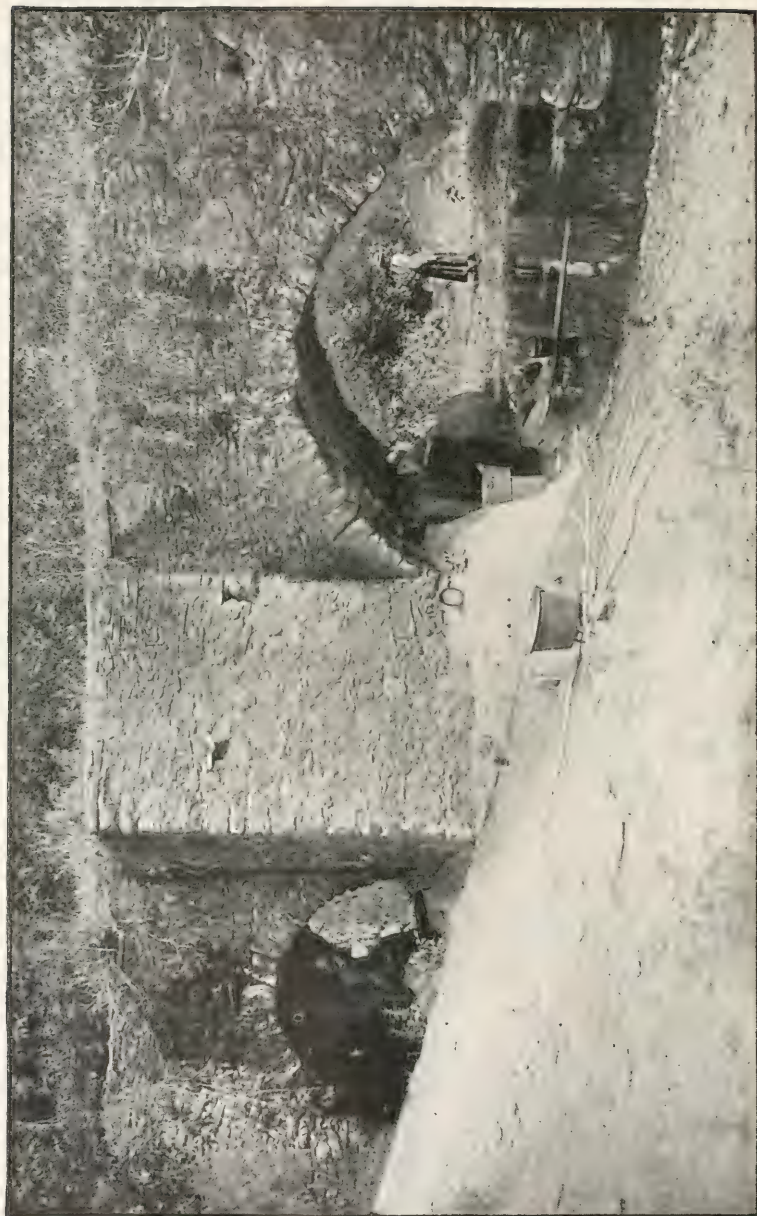


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Forestry and Irrigation.

VOL. X.

SEPTEMBER, 1904.

No. 9.

NEWS AND NOTES.

A New Term.

Mr. Gifford Pinchot in the accompanying letter proposes a new word for use in forestry, and one that seems not only good, but necessary. As he explains it, "silvics" deals with the behavior of trees in the forest in relation to their environment, or is the science which has to do with the life of forest trees. But the letter is self-explanatory:

Mr. H. M. SUTER,

*Editor Forestry and Irrigation,
Washington, D. C.*

DEAR SIR: I submit herewith a new term and its definition, which I desire to propose for use in forestry. It is "silvics." It would, for example, if practically used, replace the term "silvicultural characteristics," so that we would speak of the silvics of a tree just as we would speak of the optics of a kind of glass. With silvics in use, then silviculture would be restricted to a definite use in connection with actual work in the woods, or to the reproduction, planting, and tending of woods, while silvics would denote the knowledge necessary for a man who desired to practice silviculture, just as an engineer would have a knowledge of mechanics. The word is formed upon the analogy, for example, of words like optics, which deals with the relation of substances to light, or mechanics, which deals with the behavior of forces and their effect on matter in general.

Very sincerely yours,

GIFFORD PINCHOT,
Forester.



Well Records. The United States Geological Survey has recently perfected plans for the systematic collection and preservation of well rec-

ords and samples. The demand for information regarding wells has become so great that the Survey has decided to issue an annual publication containing a brief account of the wells bored each year. This report will be published as near the beginning of the year as practicable, and will be sent to all those who apply for it. It will contain the names and addresses of persons doing well work, and will summarize the work done by them in the preceding year.

In order to obtain data for such a year book, the Survey wishes to make arrangements with well drillers and well owners to send samples and records to the Survey's headquarters in Washington, D. C. On receipt of names of persons willing to save samples of well borings, the Survey will at once send them supplies of canvas bags in which they may transmit them through the mails without paying postage. As these samples may be sent as often as the drillers visit the postoffice, there is no danger that they will accumulate and become burdensome. For the keeping of a log, a convenient pocket memorandum book will also be provided.

It is to be hoped that the drillers and well owners of the country will appreciate the importance of the Survey's effort, and will coöperate so heartily as to assure its complete success. It should appeal to them for several reasons:

First. Their names and work will be kept before a class of readers interested in well drilling.

Second. Records of their work will be carefully filed in the office of the Survey, and will be readily available to them at any time, so that in case their notes are lost they can be duplicated.

Third. Their coöperation will aid materially in the study of the geologic

structure of the United States, and will thus assist in obtaining knowledge which can not fail to be of ultimate benefit to well drillers.

It may sometimes be necessary to regard the records as confidential. In such cases the information will be carefully guarded, and used only under the conditions stipulated by the informant.

The Director of the Survey will be glad to have an expression of opinion regarding this work from well owners and drillers, and will be grateful to them for any suggestions.

A Good Recommendation. In a letter from Mr. Hutchins, Conservator of Forests at Cape Town, mention is made of a student who comes from South Africa to attend the Yale Forest School this fall. This is a feather in the cap of American forest school work and its practical applicability to all conditions, as well as a special tribute to the reputation and value of the institution at Yale.

Irrigation Congress Notes. Everything promises well for the irrigation congress to be held at El Paso, November 15 to 18. This is the twelfth national gathering, and Executive Chairman Boothe expects not less than 3,000 delegates, besides a great number of persons who will take advantage of the trip. It has been suggested that President Roosevelt and President Diaz, the "grand old man" of Mexico, may meet at the congress, held near the international boundary line. It would be a unique occasion and the first of its kind in American history. At any rate, it is practically assured that President Diaz will be present, for he is deeply interested in irrigation and the reclamation of large arid tracts of land in the northern and central portions of Mexico, and is willing to encourage any movement tending to the betterment of agricultural conditions in his domain and along the adjacent Rio Grande borders. It is his intention in November to visit Europe after touring the United States, and it

is his purpose, as already signified, to stop at El Paso and attend the National Irrigation Congress.

During his absence from Mexico, Vice-President Ramon Corral will occupy the office of chief executive, and President Diaz will be permitted, for the first time since his ascendancy to power in the Republic, to leave for an indefinite period the country whose destinies he has controlled for more than a generation.

Proposed Reserve in Wisconsin.

Mr. E. M. Griffith, superintendent of the state forests of Wisconsin, has requested the Land Commissioners to withdraw from sale, pending a detailed examination as to their suitability for the purposes of a forest reserve, some 24,000 acres of land in Iron county, that state. The land being considered adjoins some 10,000 acres of forest reserve in Vilas county, and also the Lac du Flambeau Indian Reservation, which contains over 80,000, making a total of over 114,000 acres, all of which should be protected from fire and logged conservatively. Much of the Iron County area is swamp and marsh land which should be replanted to forest, provided that they can not be made fit for agriculture by proper cultivation and drainage. Mr. Griffith is having a careful examination made of all these lands in order that he may report to the legislature which should be retained for reserve and which should be re-offered for sale. Both the Department of Agriculture and the Geological Survey of the University of Wisconsin are assisting in the work of examination and survey.

Wisconsin and Fires.

Undoubtedly the greatest forest problem in Wisconsin, as elsewhere, is found in forest fires. During most of this year, however, there were no bad fires, except in May, which was very dry. The forest fire or fire warden law of Wisconsin has been found a good one, except for the defect that the compensation is so small that it is hard to get the best men to serve. About

300 have been appointed during the first part of the year, but by September 1, to make provision for possible fall fires, there were 450 in service. The hardest thing to contend against has been the indifference of the people, who have become so accustomed to forest fires that they accept them as a matter of course, and unless the fire is burning in valuable virgin pine practically no attention is paid to it, and the accepted program is to let it run and trust to rain to put it out before it does a great deal of damage. Wardens are, however, instructed to rigidly enforce the two following laws of the statutes of Wisconsin:

"Setting and Failing to Put Out Fire.—Whenever the fire warden of any town becomes convinced that a dangerously dry time exists in its vicinity, and that it is imprudent to set fires upon any land, he shall post or cause to be posted a notice in three public places in such town forbidding the setting of such fire therein, and after the posting of such notices no person shall set any fire upon any land in said town, except for warming the person or cooking food, until written permission has been received from one of the fire wardens of said town. All persons who start camp fires shall exercise all reasonable precautions to prevent damage therefrom and shall entirely extinguish the same before leaving them. Every person violating any provision of this section shall be punished by a fine of not more than fifty dollars or by imprisonment in the county jail not more than six months for each offense.

"Same.—Any person who shall build a fire on any lands in this state not his own or under his control, except as hereinafter provided, shall, before leaving the same, totally extinguish it, and upon failure to do so shall be punished by a fine not exceeding one hundred dollars or by imprisonment in the county jail not exceeding one month, or by both such fine and imprisonment. Any person who shall willfully or negligently set fire to or assist another to set fire on any land, whereby such land is injured or endangered, or shall willfully or negligently suffer any fire upon his own land to escape beyond the limits

thereof, to the injury of the land of another, shall be punished as hereinbefore provided and be liable to the person injured for all damage that may be caused by the fire."



Underflow of Arkansas. The investigation of the underflow in the Arkansas River Valley in western Kansas, under the direction of Mr. Charles S. Slichter, of the U. S. Geological Survey, is drawing to a close. Operations have been extended to a line of stations at Deerfield, Kansas, and in two locations near Hartland. The conditions at Deerfield were found to be similar to those near Garden City. The materials are not quite as uniform, but the average ground water velocities are quite as high.

The range of velocities near Hartland were from 6 to 24 feet per 24 hours, and the general direction of seepage is, as at former stations, in a general easterly direction, corresponding to the slope of the valley.

After carefully going over the entire situation, Mr. Slichter has concluded that the most feasible site for an infiltration gallery is in the neighborhood of Deerfield, at a point about $1\frac{1}{2}$ miles above the headgates of the Farmers' Ditch, and if a successful gallery can be constructed its waters could discharge into the Farmers' Ditch and so reach the uplands.

The investigation shows that water can be pumped so cheaply in the bottom lands of the Arkansas Valley that an infiltration gallery designed to provide water for such lands would be impracticable. At a point near Lakin and Hartland there is found the "mouth" of the disappearing stream known as Bear Creek. This is a perennial stream that disappears as soon as it reaches the sand hills, 5 to 10 miles south of the channel of the Arkansas. Mr. Slichter measured the underflow in the dry "flood channel" of Bear Creek and found that the motion is across the channel of the creek, but down stream, with reference to the Arkansas valley, following the usual direction of the water of the Arkansas Underflow.



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AN IDAHO FOREST DESTROYED BY FOREST FIRES.

In line with the channel of Bear Creek, as it is about to emerge from the sand hills, is a small body of water known as Clear Lake. An investigation of this lake, looking to its usefulness to the water users on the south side of the Arkansas River, was made. A hydrographic map was made and a test well, 70 feet deep, sunk in the bottom of the lake. Its waters were found to be lower than the river, and its bottom is composed of about 50 feet of black mud.

Test borings and underflow measurements in the rock narrows of the Arkansas, above Lakin, were made, and there are indications that a rock floor extends across the channel at this point. The work on the Arkansas has been full of interest and has been successfully carried on in spite of the constant troublesome floods which made it extremely difficult.

Withdrawn for Yakima Project.

In compliance with the recommendation of the acting Director of the U. S. Geological Survey, the Secretary of the Interior has temporarily withdrawn from any form of disposition whatever the following described lands, except any tracts the title to which has passed out of the United States, lying partly in surveyed and partly in unsurveyed land in Yakima county, State of Washington, surrounding Lakes Clealum, Kachess, and Keechelus. These lands are temporarily withdrawn from entry for irrigation works in connection with the proposed Yakima project.

Clealum Reservoir Site.—Township 20 north, range 14 east, sections 2, 3, 4, 10, 11, and 12. A strip of land one-half mile wide, $7\frac{1}{2}$ miles long, extending on the west side of Lake Clealum and Clealum River in a northerly direction from the north line of township 20.

A strip of land one-half mile wide, 8 miles long, extending along the east bank of Clealum Lake and Clealum River, extending from the north line of township 20 in a northerly direction.

Kachess Reservoir Site.—A strip of land one-half mile wide, 12 miles long,

extending on the west bank of Kachess Lake, Little Kachess Lake, and the main streams flowing into the northerly end of Little Kachess Lake and between Little Kachess Lake and Kachess Lake, said strip of land extending from the north line of township 20 north in a northerly direction a distance of 12 miles.

A strip of land one-half mile wide, 12 miles long, extending along the east bank of Kachess Lake, Little Kachess Lake, the river flowing between Kachess Lake and Little Kachess Lake, and the river flowing into the north end of Little Kachess Lake, said strip of land extending 12 miles in a northerly direction from the north line of township 20 north, said land being unsurveyed.

Keechelus Reservoir Site.—A strip of land one-half mile wide, $4\frac{1}{2}$ miles long, extending along the west bank of Keechelus Lake.

A strip of land 1 mile wide, 1 mile long, extending along the west bank of Yakima River and south of the strip of land hereinabove described.

A strip of land 1 mile wide, $2\frac{1}{2}$ miles long, extending along the west bank of Gold Creek north of Keechelus Lake.

A strip of land one-half mile wide, $3\frac{1}{2}$ miles long, extending along the east bank of Keechelus Lake.

A strip of land one-half mile wide, 1 mile long, along the east bank of Yakima River, adjoining the above-described strip of land on the south and east.

A strip of land one-half mile wide, 3 miles long, extending along the east bank of Gold Creek north of Lake Keechelus, all of said land being on unsurveyed ground.

American Mining Congress.

During the sessions of the American Mining Congress, held at Portland, Oregon, during the latter part of August, addresses were made by Mr. Newell and Mr. Pinchot, of the Public Lands Commission. The following resolutions were adopted:

“Resolved, That the American Mining Congress heartily favors the con-

servative use of forest resources, whether in public or in private hands, and in particular the creation and management of forest reserves under practical business-like rules and regulations, to the end that local timber supplies may be maintained for mining and other uses; and,

"*Resolved*, That the interest of the mining industry, to which timber and water alike are essential, the care and management of all government forest reserves, except as to titles, should be transferred from the General Land Office to the United States Department of Agriculture in accordance with the recommendations of the President, the Secretary of the Interior, and the Commissioner of the General Land Office."



Trial of Forestry.

As the result of investigations and representations of Mr. E. A. Sterling and Mr. W. F. Hubbard, of the Bureau of Forestry, the Madera Sugar Pine Lumber Company, a large lumber concern in the middle Sierras, has decided to try forty acres of woodland under forestry regulations as an experiment. Upon this tract a system of fire protection and a method of conservative lumbering will be put into practice immediately. It is the intention to lumber this land in such a manner that the maximum amount of timber can be removed and at the same time assuring a reproduction of the valuable species and a subsequent protection of the same from fire. Only the simplest and cheapest methods will be experimented with, but if definite results can be obtained the knowledge gained will be of great value to practical work.



Progress in Idaho.

Mr. D. W. Ross, Engineer in charge of the reclamation work in

Idaho, reports active operations in that state during the month of August, as follows:

Minidoka Project.—During the month the topographic parties finished taking topography on the north side of Snake River; final location was made of the

North Side Canal down to the first main branches, test pits being sunk every 300 feet and borings made about every 100 feet. Investigations were completed at the site for the power-house, and a map prepared showing by 10-foot contours the lay of the bed rock at this place. An examination was made of lands near the upper river to be flooded by backwater, and estimates of their value made. Preparations for actual construction will be pushed rapidly during the coming month.

Payette-Boisé Project.—The assistant engineers in charge of field parties in this section completed surveys of the preliminary location of the main canal systems of the Payette-Boisé project, besides doing considerable line topography on same.

Dubois Project—Surveys for reservoir sites were made during the month on the headwaters of Fall River and in the vicinity of Lewis and Shoshone lakes on the South Fork of Snake River. In the opinion of the engineers in charge of this work, it will be feasible to divert the waters of South Fork into Fall River drainage, converting Lewis and Shoshone lakes into a reservoir which may be used in connection with either stream.

Reservoir surveys were made in August on the Big and Little Wood rivers and Big Lost River, and reconnaissance surveys on the Payette River were completed. The engineer in charge of this work is now engaged in platting up the results of his investigations on the Boisé and Payette drainage.

Stream-gaging work was kept up throughout the month and a great deal of canal-measurement work was done on the upper Snake River.

Altogether the progress made in Idaho by the engineers of the Reclamation Service is most gratifying, not only to the members of the Service, but to every citizen who has the welfare of this section at heart.



Modern

Irrigation Law.

Mr. Morris Bien, of the United States Reclamation Service, at the request of the two commissions appointed by the governors of Oregon and Wash-

ington, has prepared a draft of an irrigation code to be considered by these commissions and presented to their legislatures next winter. It is hoped that the two states will adopt substantially the same code of law upon this subject. The draft by Mr. Bien is prepared along the lines indicated as necessary by modern development of irrigation work. It incorporates the fundamental principles of irrigation law declared in the National Reclamation Act, that beneficial use is the basis, the measure, and the limit of water rights. It incorporates also several provisions that will be of importance in connection with the work of the Reclamation Service in the construction of large irrigation systems. This work will be greatly facilitated by the enactment of such provisions. The salient features of this draft will be presented to our readers in the October issue of **FORESTRY AND IRRIGATION**.

Co-operative Irrigation. Many Eastern farmers would have their eyes opened as to the value of the water running through their farms if they could see the irrigation development in the Milk River Valley and how easy it is to construct small irrigation systems.

An irrigation canal has just been completed at Hinsdale—the Rock Creek Canal—which will water sixty 160-acre farms. Every particle of the work has been done by the owners of these farms. Each man's work and team has been credited against the cost of the construction, and the actual cash outlay has been less than \$1 per acre. The total cost of the building of the dam, the main canal, and the lateral ditches and actually getting the water onto the land is about \$5 per acre. This is an extremely favorable condition, and the men who have gone into this undertaking are fortunate. They now have land with a perpetual water right, the crops are assured, and the average homestead will produce \$1,500 a year above all expenses. Better than that, it will produce, with intelligent handling by some of the owners, \$2,000 or \$2,500,

for agriculture in that section of the northwest is just emerging from a comparatively crude state. It is a region where 35 bushels of wheat, 50 bushels of barley, and 60 bushels of oats to the acre can be produced. It is another case of the development of a mere flag station into a thriving community.

New Members.

The following persons have joined the American Forestry Association since June 30, 1904:

Besley, F. W., Halsey, Neb.
 Browne, Mrs. George, 407 G street, S., Tacoma, Wash.
 Bryant, John Duncan, Box 1955, Boston, Mass.
 Costikyan, S. S., 62 Harrison street, Montclair, N. J.
 Detwiler, S. B., Bureau of Forestry, Washington, D. C.
 Edwards, Samuel, Hudson, N. Y.
 Grimes, E. P., Jonesburg, Maine.
 Hatley, John C., 71 Board of Trade building, Chicago, Ill.
 Hurst, Edgar R., Forestry Bureau, Manila, P. I.
 Jay, B. F., Mesa, Colo.
 Mason, Miss Cassity E., "The Castle," Tarrytown, N. Y.
 Merrill, H. G., Andover, Mass.
 Mixer, Charles A., Rumford Falls, Maine.
 Parnay, S. Y., 167 Pearl street, Pasadena, Cal.
 Ryerson, A. N., Noroton Heights, Conn.
 Searle, Avery T., care of Bassett & Co., Pasadena, Cal.
 Sheldon, Mrs. Nicholas, Box 188, Cohasset, Mass.
 Shipway, John H., Noroton Heights, Conn.
 Spafford, Dr. F. A., Flandreau, S. Dak.
 Stevens, M. T., North Andover, Mass.
 Stuart, R. Y., Carlisle, Penn.
 Wells, George T. (*Life member*), Drifton, Pa.
 White, T. Brook, Belle Fourche, S. Dak.

Course in Forestry.

The turning out of skilled foresters is no inconsiderable part of the valuable work of the Bureau of Forestry. No profession is so little crowded, and none offers a more inviting field to the conscientious and zealous student. That forestry, as a science essential to the well-being of the nation, is steadily growing in popular favor is evidenced by the increasing number of schools and professorships of forestry that are established. The latest professorship

is that at the agricultural college at Ames, Iowa, called the Iowa State College. To fill this position it has chosen Mr. Hugh P. Baker, of the Bureau of Forestry. Mr. Baker is a graduate of the Michigan Agricultural College and the Yale Forest School, and has had a wide experience in handling problems in forestry in the West. He will lecture at the college half of each year on general forestry in its application to Iowa conditions. The other half of the year he will devote to Bureau work, for the most part investigating forest problems as they concern the State of Iowa.

**Opportunity
for Woodlot
Owners.**

Throughout the North-eastern States, from Massachusetts to Maryland, and as far west as

Indiana, chestnut holds an important place as a timber tree. Commercially, it is chiefly in demand for ties, telegraph and telephone poles, and posts, for all of which purposes, as well as for some constructional uses, it is especially adapted by its peculiar power to resist decay in contact with the soil. It is also largely used for fuel and general farm purposes. In Maryland alone, according to the Twelfth Census, its annual market yield of lumber, railroad ties, and telegraph and telephone poles amounts to over \$100,000, besides large supplies of material for local consumption.

It happens that chestnut is especially fitted for management in farmers' woodlots. Before scientific forestry began to be heard of in the United States, and when forest preservation was not uncommonly talked about as a sentimental fad, the thrifty owners of the small tracts of woodland which cover so much of southern New England, New York, Pennsylvania, and neighboring states had long been cutting successive crops of the hardwoods which sprout rapidly from the stump, thus practicing more or less rudely what the forester calls the "pure coppice" method of management. The superior market for chestnut, combined with its rapid growth, gave it, on the whole, the leading place in the esteem of these woodlot owners, who by

winter cutting were able to turn to good account time for which farm occupations gave no other employment.

The results of a study recently conducted and soon to be published by the Bureau of Forestry show strikingly the advantages of chestnut for this kind of management, and at the same time suggest some very practical conclusions concerning how the methods now in vogue may be improved. Like other trees which reproduce by sprouting, chestnut loses its vigor when the root system becomes too old. Trees grown from seed increase, both in height and bulk, more slowly for many years than those grown as sprouts from the stump. But by the time the trees are from 80 to 100 years old the seedling trees will catch up, and eventually reach a larger size than the others. For ordinary uses, however, chestnut is cut long before this age is reached, and coppicing is therefore the best way to raise it. But unless new seedling growth starts in the forest along with the sprout growth, the declining vigor of the old root systems will result in smaller and smaller production until only a sickly stand of inferior timber is left to draw on.

Chestnut tends to produce seed abundantly, and if the nuts were left to sow themselves, the forest would take care of itself very well. But crows and squirrels and other animals levy a heavy toll. Far more formidable, however, in well-settled regions, are the gatherers of nuts for the market. With chestnuts selling at an average of \$2.50 a bushel, there is a premium on the seed crop which makes propagation of the tree through this means a matter of dubious chance. When in addition the hogs are permitted to range the woods for mast, and cattle to browse the tender shoots as they rise from the ground, the prospect of seedling growth is small indeed.

Chestnut is not exacting in its soil requirements. Its roots spread comparatively deep, so that it is not so sensitive to fire or humus destruction from any cause as most species. Its sprouts grow so fast that a height of 7 or 8 feet at the end of the first season is not uncommon, and its stumps are so vigorous that one will often produce 40 to 50

sprouts. Not more than one in 8 or 10 of these will mature, but by selecting the most promising the full vigor of the parent stump may be concentrated on them to the great improvement of their rate of growth. The observations made by the Bureau have proved that low stumps produce more vigorous sprouts than high ones, and that winter or spring cutting is followed by better results than that done in the summer or fall. Telephone poles are grown in Maryland from healthy stumps in from 35 to 38 years, and ties may profitably be cut in about 29 years. Too early cutting of ties should be discouraged as wasteful in the long run. The practice of permitting contractors to cut unrestrictedly for a given sum is one which works much injury to the permanent productiveness of the woods.

Although the study of the Bureau of Forestry, already referred to, was confined to southern Maryland, many of its conclusions are applicable, with proper local modifications, to chestnut throughout its range. It is an illustration of the practical work which the Bureau is doing for the benefit of the mass of owners of small tracts of timberland, for whom the employment of the services of a forester is out of the question, but for whom the application of the knowledge furnished by scientific forestry is essential if they are to reap the full value of their holdings.



Power Development on Missouri.

Mr. H. A. Storrs, Electrical Engineer of the Reclamation Service, is about to begin investigations for the purpose of determining the feasibility of a steam power and pumping system on the Missouri River near Bismarck, North Dakota. An abundant supply of lignite exists in that vicinity, and it is proposed, if feasible, to locate a central steam plant on the east bank of the Missouri River adjacent to a bed of lignite, this plant to generate electric power to be transmitted up and down the river to pumping plants placed at points most favorable for raising water to the top of the bluffs.

Preliminary surveys will be run back

from the bluffs to determine the most advantageous arrangement of distributing canals and the existence of possible reservoir sites for storing water. The investigation will also include the determination of the quantity and quality of fuel available; the range of rise and fall of the river; amount of sand in the water; character of ground on which power and pumping plants would be built; the difficulties to be expected in building and maintaining a transmission line; climatic conditions; relative amounts of government and private lands; character of the soil and information as to the value and character of crops, transportation, etc.

An outline of the work is being carefully planned by Mr. Storrs from maps and other available data, so there will be no delay in the investigation after the party enters the field.



Bureau of Forestry Field Work.

In addition to its force engaged in forest-reserve work, the Bureau of Forestry has this summer 116 skilled men in the field. Of these 68, scattered in 26 states, are studying commercial trees, making working plans for woodlots and forests, and gathering data invaluable for the proper management of wooded areas. The remaining 48 experts, divided among 10 other states, are studying means of replacing the forest on lands from which it has been denuded, making planting plans for tracts to be forested, and planting in the western forest reserves. The data they will gather will be worked over and condensed by the office force this winter, and put into shape for practical use. Reports from the field which are coming in daily show that the year is to be one of distinct achievement, and that the work is progressing everywhere with important advance in American forestry. These experts, in covering their various territories, are zealous missionaries in the cause they serve, for wherever their work carries them the purpose of forestry, its methods, and its incalculable importance to the general welfare are understood, appreciated, and applied as never before.



MR. HOMER HAMLIN.

WHO IS DOING NOTABLE WORK IN CONNECTION WITH THE YUMA RECLAMATION PROJECT.

MAKING the greatest possible use of the Colorado River is one of the huge undertakings of the United States Reclamation Service, and in this Mr. Hamlin is assuming much of the responsible work. He was born at Pine Island, Minn., August 27, 1864, and educated in the common schools and high school, later adding to the knowledge gained there by independent study. During the period 1887-1893 he was city engineer at San Diego, Cal., and until 1895 was engaged in a general engineering and surveying business in the same city. In 1894 he was made assistant to the United States engineers in their survey for fortifications on Point Loma and Coronado Beach, and in 1895 he was located at Los Angeles as a draftsman; also serving in the surveyor's office of Los Angeles county. In 1895 Mr. Hamlin was appointed to a position in the office of the city engineer, Los Angeles, and in 1897 served in the office of the county surveyor of that county, becoming in 1899 deputy city engineer of Los Angeles. In 1901 he joined the federal government, serving with the hydrographic and hydrologic investigations under the Geological Survey, and in 1902 continued this work. On January 1, 1903, Mr. Hamlin was appointed to the position of engineer in the Reclamation Service.

FORESTRY AT THE WORLD'S FAIR.

BY

ALFRED GASKILL.

THE great World's Fair now open at St. Louis affords an opportunity to measure the real progress that forestry has made in the United States within a decade. At the Chicago Fair, in 1893, a comparatively small building served to exhibit the country's forest interests and their relation to other subjects. The building devoted to the two departments of Forestry and Fish and Game at St. Louis covers 4.1 acres, and about 4 acres more are given to outdoor exhibits and demonstrations.

But too much is said of size at St. Louis. Quality does not always keep pace with it. This, however, is probably less true of the forestry department than of several others.

It is an old idea that forestry and game culture go together, and therefore not unnatural to find the two combined at the Fair. There is an advantage in it in that the animals, live or mounted, serve as attractions to many people, who incidentally get some knowledge of the forestry side; yet one wishes that irrigation and the interests of the farmers could be substituted for those of the hunters. The latter are often not hunters at all, but city people whose ideas of forests and forestry are chiefly of the sentimental or irresponsible kind. The hope of forestry rests more in enlisting the active interest of country people than in the enthusiasm of city dwellers. The concentration of effort that is possible in populous centers supplies a great initial force, but unless the movement reach those who are directly concerned, there is no real result.

Inside and around the Forestry, Fish and Game building are many interesting exhibits of animals—live, stuffed, or painted. Aquaria in the Missouri, Pennsylvania, and New Jersey sections show many kinds of fishes in salt and fresh water. Yet these things must be passed over; the visitor will be

sure to see what he wants of them, for in many cases they are shown side by side with what more particularly belongs to forestry.

With some exceptions, the exhibits are made by states, the national and foreign governments, or by associations. Few individual exhibitors appear, unless it be as participators in state displays. This, of course, is regrettable, in that it limits the variety of products and processes that may be seen; it is a distinct advantage in lessening the purely commercial aspect of the show.

Some of the exhibits most worthy of note are the following:

EXHIBITS BY FOREIGN COUNTRIES.

Germany.—In a pavilion, whose central space is occupied by a life-size bust of Emperor William in hunting costume, are shown, by means of pictures, maps, models, and tools, the technical side of forestry. The maps are copies of those used by the forest officers. The pictures show the character of the forests, and the labels on them explain what the management seeks and what it has attained. A model of a broad-leaf forest, with trees about 15 inches tall and ingeniously constructed of twigs and sponges, demonstrates the philosophy of thinnings. Various statistical charts also are interesting and the library of forest books. This exhibit is especially of Prussian forests, their problems and practices, and of the two Prussian forest schools, Eberswalde and Münden. It is the only distinctly technical exhibit made and is in every way worthy of careful study. The uniformed forester in charge speaks English and likes to answer questions.

Japan.—As in every department of the Fair, the new world power has an extensive exhibit in the forestry building, though a large part of it is devoted to

its fisheries. That the country is keenly alive to the need of looking after its forests is shown by a carefully prepared series of forest maps and a number of charts, all on German models, giving graphic information concerning the area, value, yield, etc., of the forest interests of the nation. A large number of fine specimens of commercial woods is also shown; each is carefully labeled with the scientific as well as the local names. In going over these samples one is struck with the considerable number of clear, soft, easy-working woods. If Japan were prepared to export these, she would have no difficulty in finding a market for them, but it is said that the available quantity of none is great.

can be taken down, may serve to put up a hundred buildings. A separate exhibit in the French section shows a fine collection of willow basket ware. It would be interesting to see more of this work, since an effort is now making to extend the industry in this country; but, so far as I know, this exhibit is the only one at the Fair.

Great Britain exhibits no forestry to speak of. A few photographs are interesting in showing the kind of timber that is esteemed there, and we who insist on clear, straight, white oak may learn something from the taste of the English that will profit our forests.

Canada.—The great rustic arch, which forms the chief feature of the Canadian



FOREST, FISH, AND GAME BUILDING, LOUISIANA PURCHASE EXPOSITION.

Perhaps the most interesting feature of the whole exhibit is a collection of bamboos—clear, straight, beautiful specimens—from the little knotty ones that are used for switch canes to poles 6 inches in diameter and 40 feet long.

France—makes only a small forestry exhibit; there are some fine specimens of cabinet woods, none of them native, and an interesting demonstration of quarter sawing on several sections of oak logs, but nothing of the French silviculture or forest management that one would like to see. A model of a city building with pole scaffolding such as is universally used in Europe presents a striking contrast between their and our ways of using wood. Such a scaffolding, the pieces all lashed, not nailed, together so that it

exhibit, is an attractive piece of work; yet one wonders what it is for. The legend that it bears in letters of gold—

OVER THREE THOUSAND
VARIETIES OF WOOD
USED IN THIS RUSTIC WORK :
ALL GROWN IN CANADA

is false of course, and the statement is but little bettered when it is explained that most of the pieces are from fruit-tree stock, every nurseryman's variety counting one. The exhibit is really valuable in giving information relative to the Dominion's forest industries, the location and character of its timber lands, etc. These are set forth on placards and in an attractive booklet. In a separate building nearby are shown

some fine specimens of Canadian logs and lumber, and the only exhibit of pulp wood at the Fair. The Canadian species, of course, are the same as those found in our northern states.

Other Foreign Countries.—Mexico, Brazil, Venezuela, Argentina, Cuba, and some other countries make exhibits of woods, and sometimes of herbarium specimens, that are interesting botanically; yet, since no one goes to a Fair to study such things, their value is not apparent. It is well known that few tropical woods are commercially important, because they are unworkable or too widely scattered; consequently most of the specimens might as well have been left at home. One likes to see *Quebracho colorado*, the Argentina wood that is so rich in tannin, and to recognize in the really great Brazilian collection some of the more familiar cabinet woods, but it is impossible to go into details. The Portuguese exhibit of cork would be more interesting if it showed even a little of the methods employed in handling the cork bark. As it stands, it is out of place in the forestry building, being purely a manufacturer's exhibit.

PHILIPPINES.

In the Philippine concession a large building is devoted to the forest products of the islands. Much space is given to specimens of fruits, fibers, gums, etc., and though there are many fine samples of wood, one is a little disappointed in the collection as a whole, in view of the reports that have been published about the size and quality of Philippine timbers. The woods are characteristically tropical, most of them heavy, hard, and full of defects, and consequently of relatively little worth. The labels are good, and might well furnish suggestions to other exhibitors.

THE UNITED STATES.

Comparisons between the exhibits of the several states are inevitable, and if the task be undertaken here it is in an effort to point out what appear to be the deficiencies of some of them. An exhibit at an exposition is meant to instruct, and the extent to which it does that must be the measure of its success.

The reader will bear in mind that what is here said refers to the forest exhibits only—not to the fish and game that often share the same space, nor to the attendants. In not a few cases information that the exhibit itself fails to give can be obtained from the capable men in charge.

Arkansas.—Two-thirds of the space allotted to the state that contains more hardwood than any other is filled with samples of short-leaf pine flooring, siding, etc., all varnished. There are specimens of nearly all the native woods, it is true, yet they represent very inadequately the actual quality of much of the lumber that is produced. A few white oak staves, ash oars and handles, and hickory wagon stock represent the very important industries in those lines. Several samples of turned ware in tupelo gum suggest many uses for that light, soft, clean, and much-despised wood.

California.—California's exhibit is a disappointment; not because it has been shown before, but because it does not truly present the real resources of the state. Redwood is dominant naturally, but in the inside exhibit it is shown chiefly as a cabinet wood, in burls and veneers or as freaks. The same is true of all the other woods. The specimens are fine without a doubt, but where is the sugar pine, the western yellow pine, the common lumber and shingles, and the information about them all that should be the state's chief care? Outside the building is shown a western yellow pine stem 145 feet long, 45 inches in diameter at the butt, and 28 inches in diameter at the top, necessarily cut into 9 logs to be brought hither, and a sugar pine log 8 by 14 feet.

Georgia.—The chief interest in this exhibit attaches to a collection of turpentine trees, tools, distilling apparatus, and products. The material is more complete than that of the Bureau of Forestry, though not so well arranged. There is also a good collection of wood specimens and some sample pieces of hardwood furniture, but neither give much of an idea of what the lumber resources of the state are. Of forestry there is no suggestion other than that

furnished by the distribution maps on a number of log specimens.

Kentucky.—This state has a very good exhibit of hardwood products. It is chiefly made up of samples from various industrial establishments arranged to show the special uses for which the more important woods are fit, and in this respect is interesting and valuable. The specimens are carefully labeled, though there is the usual confusion of common names.

Louisiana groups a good collection of wood specimens about a large-scale relief map of the state, colored to show in a broad way the character of the forests. Various wood products are also shown, but the exhibit lacks the definiteness in detail that is found in some others.

Michigan.—Here is an example of pretty good material made of little avail by faulty treatment. The exhibit is a collection of small photographs, placards, and wooden ware, jumbled up with some lumber specimens. There is information to be gained if one takes the trouble to hunt for it, but few are disposed to do that.

Mississippi.—The wealth of forests that is known to exist in this state is only suggested by the exhibit made. A considerable space is filled with wood specimens, but many of them are not even labeled, and one has difficulty in getting any information of practical value from what is shown.

Missouri.—The home state of the exposition is accorded the place of honor in the Forestry building and a space larger than that of any other. It is occupied by a series of rather heavy booths of various woods, and those in turn by wood specimens and manufactured products. The feature that no forester or lumberman will be apt to miss is a booth, about 20 feet square and 12 feet high, constructed entirely of red gum. The display proves the value of red gum for inside finish, disproves the common contention that it can not be seasoned and used in that way, and exhibits the fitness of the wood to take many stains and a fine polish.

New York.—The Empire State makes a great exhibit in an effort to show what

forestry is. The central feature is an Adirondack log cabin, rather finely built and furnished, it must be admitted, yet showing well the attractiveness of woods life. The trees are represented by specimens of leaf, flower, and fruit and their woods by small pieces instead of by lumber forms. Outside the building about a quarter of an acre is occupied by a nursery designed to show how trees are raised and set out to renew the forest. The lumber industry is ignored entirely.

North Carolina.—The wonderfully fine collection of hardwood specimens seen at former exhibitions is here shown again. A clear black-walnut log four feet in diameter attracts much attention, as does a section of a tulip poplar tree five and one-half feet in diameter. These specimens all evidence the size and quality of the timber of the state, and stand in rather strong contrast to the gaudy furniture that is also displayed in the cabin built of pine slabs. In much of this furniture the chief aim seems to be to display the greatest amount of silver grain in what passes for quartered oak. The thing becomes ridiculous when oval drawer fronts and even cylindrical pillars and rails are made to exhibit the broad medullary markings. North Carolina is not the only offender in this respect. The whole display, though attractive in many ways, does not well represent the forest resources of the state, and nowhere does it even suggest the state's commanding position in the proposed Appalachian park and the interest its people are understood to have in that movement.

Oregon.—This exhibit is not so attractive as some, but in value it stands easily in the front rank. The indoor exhibit shows a number of unvarnished specimens of commercial lumber and a full collection of the woods of the state. Outside the building may be seen a stick of red fir 42 feet long and 4 feet square and a log of the same 9 by 30 feet.

Other features of the exhibit consist of samples of special manufactures—pine needle fiber, etc.—but most important of all is the collection of figures concerning the amount, kinds, and quality of timber in the state. It probably is true that

these figures are not entirely right, but they are collected and published in a laudable effort to give the kind of information that is worth something.

Tennessee.—This exhibit is almost without significance. A number of small wood samples make a show without telling anything, and some manufactured articles, cedar ware, etc., though good and representing important industries, are set up with nothing to indicate why they are shown. Tennessee could and should have done better. She can even yet remove a number of cross-sections of logs with longitudinal grain.

Texas.—Probably few people think of Texas as a timbered state. The exhibit here is emphatic evidence to the contrary. Two booths of longleaf pine, one in cabinet style, the other rustic, contain a fine show of that wood in commercial forms and a collection of wood specimens that, in variety and size, is not inferior to that from any other section. Unfortunately, there is no statistical or graphic information offered.

Virginia.—Virginia's interest in her forests is evidently less active than in her fisheries and oyster beds. There are some good specimens of lumber shown and a few forest pictures, yet one finds no reference to the many bodies of thrifty young timber that the state contains—growths made since the civil war—nor to the locations of mature timber, the facilities for logging, etc.

Washington.—The great forests of Washington are inadequately represented. The outer wood and bark from the butt of a red fir tree 15 feet in diameter is set up to form a room and is an attraction to many visitors, and some large planks of red fir, giant cedar, and sitka spruce show the size and quality of Washington lumber, but the extent of the forests and their economic value are nowhere shown save in a pamphlet with fine pictures and not much information.

The Washington state building is, however, a demonstration in red fir and deserves a visit on that account.

Wisconsin makes her chief exhibit of large white pine framing timbers. The booth is attractive, yet one is bound to reflect that white pine never was a structural wood, and large pieces are now too

rare to be worked into such forms except for a purpose like this. As a display of the former importance of white pine, the exhibit has considerable interest. Copies of a notice posted throughout the state evidence the activity of the forester and the desire of the people to protect and maintain the forests that are left.

Several other states make exhibits of forest products, or of work done in behalf of forestry, yet they do not deserve special mention. Far more significant is the failure of such leading states in the forestry movement as Pennsylvania, Maine, and Minnesota to show what they have done to maintain and extend their woodlands.

BUREAU OF FORESTRY.

This exhibit deserves to be studied. There is plan and purpose in it, and each feature is meant to show some part of the work in which the national government is engaged.

Inside an arcade 88 feet long and 16 feet wide, with no light but that which comes through the pictures, is displayed a great collection of photographic transparencies illustrating the forests and forest problems of the United States. One wall is devoted to the eastern half of the country, the other to the western, and the individual pictures are often so arranged that it is possible to compare conditions in the east with those in the west. The series as a whole illustrates every type of natural forest and many situations that have been modified by the skill of the forester.

Supplementing this set of pictures is a series of enlarged photographs painted in the natural colors and framed in the balustrade that encloses the exhibit space. Some of these pictures are ten feet long and give wonderful panoramic views of several forest regions. The best is probably that of Grandfather Mountain, the central feature of the proposed Appalachian Reserve. It is unfortunate that the pictures are set too low to attract general attention.

But this exhibit is not all pictures. A large case contains a set of long-leaf pine trunks showing every stage of the process of collecting the resin from which turpentine and rosin are derived,

and contrasting the old method of boxing with the new, in which cups and gutters are used. In another section the operation of timber testing is shown by a 100,000-pound testing machine, and its results by a number of beams and smaller pieces and by a series of charts and diagrams. On a relief map of the United States are shown many important facts relating to forests and forestry, and other maps give sundry kinds of information. Another important feature is the outdoor exhibit of forest planting, in which about three acres are devoted to demonstrations of how and what to plant in any section of the country. Other outside exhibits are those of practical timber-testing and wood-preserving, which are carried on daily in that part of the grounds known as "The Gulch," more than a mile from the Forestry building.

YELLOW PINE EXHIBIT.

The exhibit of the Southern Lumber Manufacturers' Association deserves special mention, because it is the only display made by a lumbermen's organization, and because it shows what a given kind of wood is good for. In the exhibit no distinction is made between long-leaf and short-leaf pine, yet the manufacturers and dealers recognize the peculiar qualities of each and furnish what is wanted.

The chief object in the exhibit is a cottage built throughout of yellow pine, stained in attractive colors outside and treated as a cabinet wood within. Each of the three rooms has a different treatment, and all are notably attractive. A car-load of short-leaf pine logs is another feature, and a series of stock samples includes the ordinary commercial grades of yellow pine. This last is especially interesting, because it is the only collection that shows anything but selected specimens.

HOO-HOO.

The building that the lumbermen's organization has erected must not be overlooked, since besides being a clubhouse it contains a series of rooms that afford a practical demonstration of the value of redwood, cypress, red gum,

and several other commercial woods for inside finish. The building was unfortunately burned down in June, and though the energy of the members restored it in less than a month, it was impossible to reproduce the original beauty of many of the rooms.

SUMMARY.

The features of the exposition that have been referred to in detail may be summed up under three heads—attractiveness, educational value, commercial value.

In general the first is satisfactory, the second and third less so. In any exhibit an object without a label to tell what it is and what it is for is a nuisance. Many collections are full of nuisances. Again, the exhibit that shows specimens without indicating their relative quantitative and qualitative importance does little to enlighten the visitor. In the Texas exhibit, for instance, are specimens of bald cypress and red willow, both of about the same size, yet with nothing to suggest that the one has little more than a botanical value, while the other is one of the most important lumber woods.

Another fault is the too general use of varnish. It is employed often in the interest of neatness, it is true; yet in several exhibits the specimens look well without it and far more natural.

The criticisms here made, whether of individual exhibits or of all together, are to be viewed in the light of an effort to measure the display by a high standard. As a whole, the forestry exhibit is creditable and highly instructive; yet in four directions it falls short of what it should be:

First. The motto of the exposition, "Processes, not products," is negated by the signal failure to have exhibited a complete set of up-to-date logging and wood-working tools and machinery. There are some stave saws, coopers' tools, and hand tools in the Forestry building, and some barrel and box machinery, a portable sawmill and some planing machines, etc., in the Machinery building; but the lumberman will look in vain for a donkey engine, a complete band mill, or a steam skidder.

Second. Except in the yellow pine exhibit, there is nowhere to be found a set of specimens illustrating lumber grades. Each exhibitor shows the best, or better than the best in a commercial scale, and the great opportunity to compare gradings in different woods and in different parts of the country is lost.

Third. An excellent opportunity to make a comparative study of woods is almost lost through the failure of exhibitors to properly label their specimens.

The confusion in common names is hopeless, and something might have been gained through an effort on the part of the management to have each specimen properly identified and marked.

Fourth. Forestry as a science or art—the means by which timber lands are maintained and improved or forests created—is a name only outside the spaces allotted to Germany, Japan, the United States Bureau of Forestry, and the State of New York. Yale is the only forest school that attempts an ex-

hibit, and that is so trifling, a map and a few pictures, that nothing were better.

But if the growth of forestry seems limited by certain defects or shortcomings in the exhibits made, the Fair itself proves the contrary. People from all parts of the country seek the Forestry building, ask for information, are disappointed that certain things are not done, and in many ways evince the liveliest interest in the new movement. There are plenty of dim ideas about what is to be done, there is still more than enough of sentimental enthusiasm; but indifference has ceased and the active opposition maintained by a few interests is giving way as the aims of forestry become understood. It is the deliberate judgment of one who has had an exceptional opportunity to learn the minds of many people that the progress made in forestry within the past 10 years is real, that it is immense, and that it will continue.

SOUTHERN FLORIDA.*

NOTES ON THE FOREST CONDITIONS OF THE SOUTHERNMOST PART OF THIS REMARKABLE PENINSULA.

BY

DR. JOHN GIFFORD.

ACCORDING to the report of the Biological Survey of the U. S. Department of Agriculture, there are three regions in the United States which belong to the Tropical Zone.

One is in southern Texas close to the mouth of the Rio Grande, another is along the Colorado River in Arizona and California, and the other is southern Florida.

The first two are hot and arid, the other is humid and pleasant throughout the major portion of the year. The southernmost part of Florida can rightfully claim, therefore, the distinction of being the only humid or truly tropical

part of the mainland of the United States—the only tropical part of this country which can be reached by rail. The lines called the tropics of Capricorn and Cancer, although of course perfectly straight on the map, are really very crooked and very difficult to definitely locate. Some claim that the frost line is the limit; if this is so no part of Florida is in the tropics, since frost has occurred, in spots at least, throughout the whole peninsula. The best guide is the character of the vegetation, and wherever the cocoanut, avocado, mango, pineapple, and hundreds of other strictly or characteristically tropical plants flourish.

* The illustrations accompanying this article are reproduced here from an article by Dr. N. L. Britton on "Explorations in Florida and the Bahamas" in the July number of the *Journal of the New York Botanical Garden*, through the courtesy of its editor, Dr. MacDougal.



ROAD THROUGH ADDISON HAMMOCK, CUTLER, FLORIDA.



ROOTS OF MANGROVE (*Rhizophora mangle*), SHORE OF BISCAYNE BAY, MIAMI, FLORIDA.

ish, and fruit without protection, the region is truly tropical.

The territory referred to in this article is unique in another respect. It is the only region of coral formation in the United States. These two peculiarities combine to render it a region of extreme interest to foresters and botanists. Here is field for research for many years to come, where many phases of plant ecology may be studied to better advantage than elsewhere on the continent. One can pass through all the climatic zones from the Boreal to the Tropical in going from the region of the proposed Appalachian Park to Biscayne Bay in a little more than twenty-four hours. Were the roads all good, it would be little more than a pleasant automobile trip.

The part of Florida to which this article refers lies between the Everglades and the Florida Strait, and includes the territory around Miami, and southward to Cape Sable, including many coral keys, mangrove islands, and wooded islands in the Everglades.

The vegetation of this district from a forestry standpoint may be divided into three distinct types—the hammock, the pineland, and the mangrove swamp. It is, of course, impossible in so short a space to give more than a superficial description of these types.

The hammock is undoubtedly the climax forest. It represents the type that the rest would in time become were it not for fire, flood, and other detrimental and retarding influences.

The hammock is a tropical jungle, consisting of species of trees characteristic of the Antillean flora. Most of these species produce a vigorous coppice, and the ground is covered with a rich black mold resulting from the leaves and detritus of these hardwoods. It is in the hammock where one finds mastic, crabwood, satin-leaf, gumbo-limbo, princewood, whitewood, manchincet, and many other rare and in many instances valuable woods.

This hammock may be found in patches in the pineland, on islands in the Everglades, on the keys north of Bahia Honda. Strange to say, the southernmost keys are like the pineland of the mainland in character. Sand Key,

seven miles to the south-southwest of Key West, is the southernmost point in the United States. Although all the keys north of Bahia Honda were once covered with a dense tropical growth, much of it has been cut for pineapple clearings. In many places, especially in Key Largo, it is still in virgin condition. Wherever these keys are above tide water, the growth is hammock; when subject to overflow, it is mangrove swamp. Some keys are all hammock, others are all mangrove, and others have hammock centers fringed with mangrove.

For half a century the timber on these keys has been cut, allowed to dry, and is then burnt. In the ashes a fine crop is produced, and fertilizers have never been used. The fact that pineapple patches are very combustible has caused these natives to burn cautiously. In referring to the vegetation of these keys I cannot refrain from quoting the following from an article by the botanist Curtiss in 'Garden and Forest,' volume I, page 279:

"A person who is acquainted only with the vegetation of more northern states, or with that of northern Florida in traversing these keys, will find scarcely a tree or herb identical with, or even resembling those with which he has been acquainted. He may hear familiar names in use by the inhabitants, such as cherry, mulberry, and cedar, but on examination he will find the species thus designated to be entirely different from those which he has known by such names before. The curiosity is piqued at every step by some unfamiliar and interesting form of vegetation, and if the tourist be accompanied by one of the inhabitants he will learn much of the popular lore regarding names and uses, for these people are remarkably intelligent in regard to the vegetable and animal life of the region they inhabit. It will be found that almost all the adult inhabitants come from the Bahamas, that nearly all the trees and other plants are common to those islands, and, in short, that these islands have much more in common with the Lesser Antilles than with the Florida mainland.



BROMELIADS ON THE LIVE OAK, MIAMI, FLORIDA.



THE SOLITARY REMAINING INDIVIDUAL OF SARGENT'S PALM (*Pseudophoenix Sargentii*),
ON ELLIOTT'S KEY, FLORIDA.

"A tour of the Florida Keys reveals nature and society under such peculiar conditions that any one who has never visited this insular region may rest assured that there remains in store for him at least one source of novel and enjoyable experience, though he may have traversed the mainland of the United States from Maine to California. As regards conformation and soil, the inhabitants and their pursuits, the surrounding waters and the marine life they support, these coral islands differ essentially from all other portions of our vast country; but in no particular do they present so striking a dissimilarity as in the vegetation which covers them."

In spite of the mosquitoes these keys are charming places, especially Elliott's, which is bounded on one side by the waters of Biscayne Bay and on the other by the straits of Florida. They are protected from storms by a chain of coral reefs. Near at hand are the famous Sea Gardens.

The pineland, although less rich and luxuriant in growth, is also peculiarly interesting. The rocky ridges or reefs, with sandy swales in between, are covered with pine and palmetto. The pine, strange to say, seems to shun the sandy swales. The sand of these swales is underlain usually with a reddish calcareous clay, resulting from the disintegration of the coral rock. This rock may be found in all stages of disintegration. In the swales the palmetto is most luxuriant, and no doubt the absence of the pines in these places is due to this fact. The regeneration of these pines, in spite of fire and rock, is generally good. The pines grow right in the rock, the roots penetrate its crevices, and the tree is anchored to such extent that when it upturns the rock upturns with it.

I am not certain that the rock of the mainland is what a geologist would call coral. On the keys the soil is certainly solid coral, crumbled coral, and coral sand. On the mainland it is a limestone as soft in places as chalk and as hard in others as flint. In places it seems stratified or in plates and lifts out in good flat building stones, which

harden on exposure; in others it is jagged, honeycombed, and filled with pot-holes and pockets; in others it is coquina-like in character, and in others has a *volitic* structure.

The pine is Cuban pine (*Pinus heterophylla*), peculiar to that region. It does not yield resin satisfactorily, and is therefore not tapped. It is so heavy that it sinks in water, and on the whole is one of the meanest woods on earth to work with. The heart or light wood is durable, but it warps to such extent and is so hard when dry that it is cut, hauled to the mill, sawn into boards, and used for constructive purposes just as soon as possible.

It is almost impossible to drive a nail into the dry wood without splitting it, and in order to saw it one must flood the tools with kerosene to prevent gumming. Lumber merchants shun it, although many people use it because of its cheapness. The sapwood soon rots and leaves a heavy, durable heart, which would be in great demand for posts, ties, poles, &c., were it not so plentiful. Much of it is used in burning the coral rock into lime, and much of it is burnt up in the clearing simply to get rid of it. The "log-rolling" stage is still on in this district. In many cases it is blasted down with dynamite and then burnt; in others it is "deadened" and then burnt standing. It would probably pay to distill this wood, since it could be secured cheaply and would yield large quantities of tar. The palmettos are being used for the manufacture of tanning extract in Miami. If a factory is established which will convert this wood, including stumps, into tar, there would be little left on this rocky ridge in the way of a cover.

Fire sweeps over these pine regions frequently. The pine needles, grass, and palmettos burn like tinder. The dry pine bark and rotten sapwood hold fire like punk. Fire gets down in the crevices of the rock, so that it is next to impossible to extinguish it. The effect of fire on this rock is peculiar. It becomes a potent geological agent. It converts the rock into lime, which slakes when wet by rain or dew. In burning piles of brush, rocks are often



PINE (*Pinus Elliottii*) AND SCRUB PALMETTO (*Serenia serrulata*) ASSOCIATION, NEAR CUTLER, FLORIDA.



BORDER OF THE EVERGLADES WEST OF CUTLER, FLORIDA ; A "PRAIRIE" IN THE BACKGROUND.

thrown into the heap to check the flames or prevent the wind from blowing sparks. These rocks are burnt with the wood and crumble into soil.

This rock crumbles into soil in the presence of decomposing organic matter. By the use of velvet beans, dynamite, and hard grubbing by Bahaman darkies, the roughest, most hopeless looking rock-bed may be converted into productive soil.

There ought to be considerable nitrogen present in this soil, since the ground is often covered with thirty or more species of creeping legumes. There must be potash somewhere, since the palmetto ash is extremely rich. Few things will grow, however, in this rock without the help of fertilizer. Plant-food materials may be there, but they are not available. The rock is usually wet, even in the driest times. In fact, under this coral ridge there are channels of water running from the Everglades and bubbling out in the form of crystal springs along the shores of Biscayne Bay.

All this pineland would in time become hammock, no doubt, were it not for forest fires. One can find all stages between the true hammock type and the pineland. Where pineland has been protected from fire, it becomes hammock-like in character.

The type of forest called mangrove consists in places of pure red mangrove, the great land-former, but gradually merges into forest similar to hammock. The vegetation of the mangrove swamp consists of those species which can stand a salt-water bath occasionally. They are located on muck lands which are being gradually wrested from the sea. The red mangrove is chief among those plants which can thrive in salt water. With it, however, are often associated the cocoanut, the seeds of which float in, become covered with wet seaweed, and then sprout and grow together with buttonwood, black mangrove, sea grape, and others. There are hundreds of thousands of acres of land in which mangrove predominates. Fringing these muck lands are often sand beaches. In the course of time, when this land becomes high and dry by the continued

deposit of vegetable detritus, other trees, such as grow in the hammock, gain a foothold and spread.

Back of this rock ridge, which stretches along the coast from the region of Miami southward, is that vast territory called the Everglades. In the Everglades there are hammock islands, on some of which the Seminole Indians live. This Everglade region, it is claimed, contains 3,760,000 acres. Since ten acres is sufficient for the support of a family in that climate, there is room for 376,000 families. The whole cultivated area of Florida is estimated at 1,000,000 acres. It is interesting to compare the size of this wild territory with other parts of the world. For instance, the Everglades cover 5,875 square miles; Porto Rico, 3,550 square miles; Rhode Island, 1,250 square miles; Delaware, 2,050 square miles; Jamaica, 4,207 square miles. When this area is once properly reclaimed there will be little of it which can not be cultivated. The complete drainage of these Everglades is not only being seriously considered, but is actually in progress. The following on the "Draining of the Everglades" is from a recent issue of *Success*, by J. E. Ingraham, one of the vice-presidents of the Florida East Coast Railroad:

"There are great agricultural possibilities in the Florida Everglades. Though they are yet merely an expansive waste of swamp and lake and jungle, I venture to predict that they will be the location of hundreds of fertile farms within ten years, and will by degrees develop into one of the most productive tracts of land in the world. The barrier to the utilization of the Everglades has been, of course, the water which covers the greater part of them to a depth of from one to six feet; but it has been found entirely practicable to drain off the water. Work to this end has already been begun and is being pushed rapidly. When it is completed a tract of land one hundred and sixty miles long and sixty wide will have been opened to cultivation. The size of this region is not as important as the remarkable productivity of the soil. The latter is not only absolutely virgin,

but has been fertilized by animal and vegetable life through many centuries. I am confident that its crops will lift Florida to a place among the leading agricultural states.

"The project of draining the Everglades attracted the attention of Henry B. Plant in the early nineties, but he was by no means sure that the scheme was feasible, so I, acting under his direction, undertook an expedition through the region. Despite its proximity to centers of population, it was then for the first time thoroughly explored by white men. Ours was virtually a voyage of discovery. We paddled our light boats on lakes and camped on islands that, I have good reason to believe, had never before been visited by any human being but Seminole Indians, and by these but rarely. We underwent so many hardships that some of our party were compelled to turn back, but our efforts were not in vain, for we ascertained the important fact that the Everglades, along the whole 160 miles of the eastern side, are rimmed by a rock ledge. We furthermore learned that all of the lakes are several feet above sea-level, and we decided that there was nothing whatever to prevent the water of the lakes from flowing into the ocean and leaving the land drained if vents could be made in this long ledge of rock. The chief question before us pertained to the practicability of cutting through the ledge in various places, and dredging out out-

lets into the Atlantic, which is not more than 2 or 3 miles away at numerous points.

"Experiment proved that this work would present no great difficulties. It was merely a matter of a great deal of digging. Henry M. Flagler took up the project, and it is being carried out by his lieutenants. We are not only making artificial outlets through the rock, but are also, by ditching and dredging, turning large bodies of water into rivers and creeks which flow to the ocean. The work has progressed far enough to enable me to predict confidently the opening in Florida, within a very few years, of a great tract of land of almost unprecedented fertility."

When one considers what the Bermudas yield, with only twenty square miles of rocky land, the possibilities of this great southern tropical peninsula seem almost limitless. The whole region is one of great interest, and although one of the first to be explored and partly settled it has remained dormant until lately. Settlement is difficult, but gradually obstacles are being overcome, and when competition in transportation facilities develops, the boom will be on in earnest.

This region of perpetual summer is the natural gateway to the West Indies, and the great peninsula of Florida, like a huge finger, directs the way to fertile regions beyond, awaiting American capital and enterprise.

THE IMPERIAL VALLEY OF CALIFORNIA.

A SPOT WHERE A REMARKABLE DEVELOPMENT HAS
TAKEN PLACE AND A GREAT FUTURE SEEMS ASSURED.

BY

GEORGE BELLIS.

IN the southwest corner of the United States, where flows the mighty Colorado River of the West, and near the international boundary line between the United States and Mexico, there has grown up within the last four years an important enterprise in the way of the

reclamation of arid America by means of irrigation.

With irrigation facilities in the Imperial Valley, a failure of the crop is an impossibility where the crop is intelligently irrigated.

The "Imperial country," as it is lo-



FIELD OF MILO MAIZE IN IMPERIAL VALLEY.

cally called, has come to be known as one of the most important and notable settlements ever planted—not only in America, but in the civilized world.

The writer has just returned from a visit of inspection to the valley, and will attempt to tell in a conservative and just way what he saw and learned of the agricultural development of the country. His information as to crops, etc., was gathered, for the most part, from farmers he met and talked with as a mere visitor to the valley and not as a newspaper correspondent.

The Imperial Valley is located in the great Colorado Desert and comprises

about 500,000 acres of fertile land—a veritable desert without water, but a fruitful garden with irrigation.

The first water for irrigation was delivered at Imperial in June, 1901, and in the short space of time required for the realization and development of this unique experiment it is conservatively estimated that 70,000 acres are already under cultivation. Upon these desert lands when supplied with water are grown, in lavish abundance, a variety of crops, among which are the following: grains, millet, Egyptian corn, alfalfa, and sorghum; and live stock, cattle, hogs, horses, and other animals.



FLOODING SCENE NEAR IMPERIAL.

Sugar beets, sugar cane, cotton, and tobacco can doubtless be produced here successfully, and other products of the soil would thrive and produce in greater abundance than on irrigated lands elsewhere in California.

The writer found wheat and barley to be the principal crops at present. These are taken from the ground in the early summer, and the ground is again planted to maize, sorghum, or millet, all of which will make good crops before the close of the season.

The average yield of grain in the valley is very high, and that of wheat is said to be forty bushels to the acre, while barley is said to yield as much as fifty bushels per acre, and the writer was informed by growers that they found a ready market for both of these crops in California and Arizona. The annual yield of wheat and barley has been from \$25 to \$30 to the acre, to say nothing of the second crop which these lands will produce.

Alfalfa is also one of the great crops of the valley, and I was surprised to find so small an acreage devoted to this great Western crop, when I learned from those raising it that the returns were so large. Alfalfa is here cut from four to eight times a year, and a reasonable estimate is from one to two tons of cured hay per acre at each cutting. A field yielding six cuttings per year and one and a half tons at each cutting means nine tons annually. This alfalfa hay has a ready sale at from \$9 to \$12 per ton.

The writer is of the opinion that this is destined to become a fruit country also, as all kinds of fruit grown here will ripen several weeks in advance of the same varieties grown in the coast valleys of southern California, and hence good prices and ready markets

will be obtained for this class of products.

Grapes will undoubtedly do well here, as the writer saw one vineyard of seedless Sultanias which was said to have been planted in the spring of 1902, and was in first-class condition and bearing.

The date palm will undoubtedly thrive better here than elsewhere in the United States, and Professor Swingle, of the United States Department of Agriculture, is the authority for the statement that the "Deglet Noor," the celebrated dessert date that retails in this country



TWO YEARS AND FOUR MONTHS PRIOR TO TAKING THIS PHOTO
THERE WAS NEITHER WATER, TREE, NOR MAN AT THIS POINT.

for fifty cents a pound, will prove a paying venture in the Imperial Valley. The government has already established an experimental farm at Heber, California, about ten miles south of the town of Imperial.

Sugar beets and rice have both been grown in an experimental way and are found to grow successfully, while early vegetables grown here will practically have the whole United States for a market.

The valley is reached by the Imperial Branch of the Southern Pacific Railroad, which was built in from Old Beach on the main line to handle the freight and passenger traffic of the valley.



ON THE INTERNATIONAL BOUNDARY LINE BETWEEN CALIFORNIA AND MEXICO.

The towns of Heber, Imperial, Brawley, Calexico, Silsbee, and Holtville have sprung up, magic-like, upon the desert and are making much progress. Mr. Willis George Emerson, of the Emerson Realty Company, is president of all six town companies.

The incorporated town of Imperial is the oldest and largest, having been started in 1901. It is on the Imperial Branch of the Southern Pacific, and has a population of about seven hundred, a national bank, ice and electric light plants; is connected with Old Beach by telephone and telegraph, and with the towns of the valley by telephone. It has two weekly papers—*The Imperial Standard* and *The Imperial Press*, a two-story brick hotel, a large grain warehouse, a creamery, and a piped water system. The Holtville Inter-Urban Railway Company has about completed an electric line which will run between Imperial and Holtville, a distance of about twelve miles.

Brawley, the second town of importance, is located on the railroad, 9 miles north of Imperial, and has many business houses already established and many more in the course of construction. This town is in the midst of the

most fertile land in the valley and is rapidly building up. It has a progressive weekly newspaper, *The Imperial Valley News*, and a bank.

Calexico is at present the terminus of the branch of the Southern Pacific and is on the United States side of the boundary line. Mexicali is a town site laid out on the Mexican side of the line. The Southern Pacific is now extending its line from Calexico to Yuma, and the future route of the tourist over this line will be via the Imperial Valley. There are two advantages that will be enjoyed on this new route when it is completed, the tourist will have the opportunity of seeing the great "Imperial country," and

will go from Calexico to Yuma over the delta lands of the Colorado instead of over the desert, as at present.

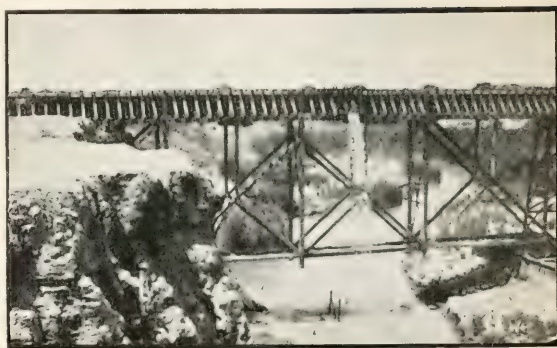
Holtville promises to become one of the leading towns of the valley, and will have the electric power plant of the Holtville Inter-Urban Railway Company, where will be developed a 2,000



DATES GROWN IN THE IMPERIAL VALLEY.



STACKED UP FOR SHIPMENT AT IMPERIAL.



FLUME OVER NEW RIVER.



MAIN CANAL, IMPERIAL WATER CO., NO. 1.



HARVESTER AND THRESHER IN IMPERIAL GRAIN FIELDS.



—SIX MONTHS' GROWTH IN THE IMPERIAL VALLEY—TEN FEET IN HEIGHT—THE FARMERS' MORTGAGE-LIFTER.



COTTAGE IN IMPERIAL.

horse-power by a drop of water some 40 feet.

The writer takes great pleasure in predicting continued success and prog-

ress for the valley, and feels sure that the present canal system, upon which the welfare of the valley depends, will in the near future be improved and extended.

FORESTRY ON EDWARDS PLATEAU.

HOW IT WILL GREATLY BENEFIT A VAST AGRICULTURAL SECTION OF LOWER TEXAS.

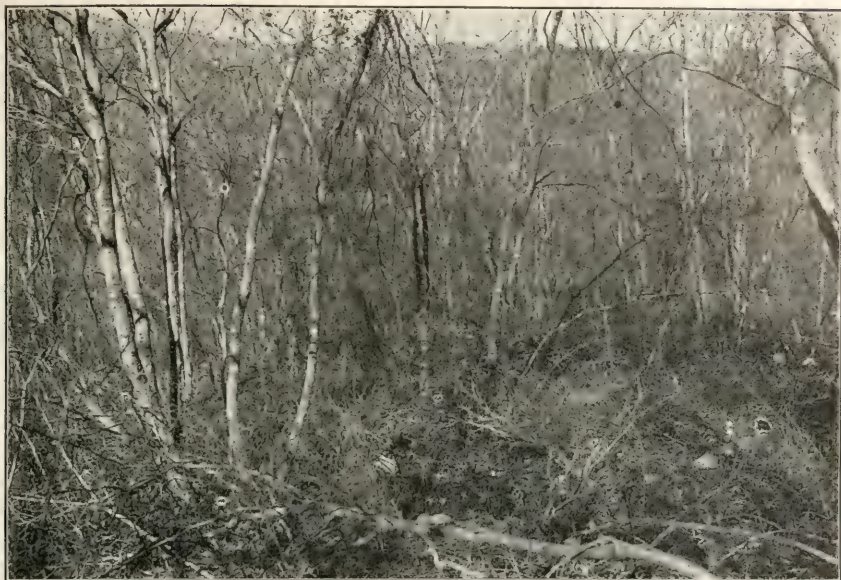
THE topography of Texas is such that a vast body of its agricultural lands can be regularly supplied with a large amount of water without employing expensive irrigation systems which are so commonly required in many Western States. Texas is provided in the Edwards Plateau with a vast rain catchment basin, which has an area of some 15,000 square miles, covering 11 whole counties and the half of 13 others in central and western Texas. Its southern boundary is a line of cliffs in the hill region, extending from Austin to San Antonio and on to Del Rio. It stretches northward from the Colorado River beyond the granite region and into the timbered portion of the Grand Prairie. An elevation at

Austin of 400 feet above the coast plain increases to 2,400 feet above sea level in its northwestern extension. The rainfall over this large territory is yielded up to the plains below through a number of rivers and a chain of superb springs issuing from the base of the escarpment which marks the plateau's southern boundary.

Dependent on the water supply of this plateau is a great stretch of the most fertile lands of Texas contained in the Rio Grande and Coast plains. These lands are in a semi-arid region and have not been fully productive because of insufficient moisture, which is due to the fact that half of the rainfall of the plateau is wasted in destructive floods. The problem is to abate these floods,



CEDAR BREAK NEAR AUSTIN WHICH HAS GROWN UP AFTER A CLEARING TWENTY-FIVE YEARS AGO.



THICK GROWTH OF SMALL, MOUNTAIN OAK ON THE SIDE OF A DEEP GORGE IN THE EDWARDS PLATEAU COUNTRY NEAR AUSTIN.

store away the water, and supply it gradually throughout the year to the farm lands below. It is believed that the application of forest management to the Edwards Plateau will do very much to accomplish this important result.

The peculiar structure of the plateau fits it to absorb and store up water. It is a limestone country with tilting strata and extensive systems of fissures and caverns. To these are due the copious springs that issue from the earth far away at the southern boundary of the plateau. The present forest cover is by no means continuous, even in the rougher sections, but is broken into by open, grassy uplands. In the canyons a heavy timber growth is found, but the principal forests are those of the hills and bluffs. These are composed of variously mixed stands of timber. The cedar brakes are very dense and contain a good proportion of heavy timber, while the tree growth of the "shineries" and of the "hardscrabble" country is stunted and found on the uplands. The mountain oak is a specially valuable species to the plateau, for it thrives in thickets on slopes of low gradient and on the hard limestone of

gorges. The forests of the hills and bluffs are the most extensive, but with the exception of the heavier growth of cedar the wood is valuable chiefly for fuel. Clearing for farm lands, cutting for fuel, and forest fires have made great inroads upon these woodlands. An important and encouraging fact is, however, that all the hill species are characteristically rapid in recovering denuded ground. Further, it is characteristic of the scrub oak to encroach upon the prairie and of mountain cedar to capture adobe slopes. Thus in the very parts of the plateau where conservative forestry should be applied to create a protective forest are found the most desirable tree species and topographic conditions most favorable to the work.

While the structure of the plateau is admirably suited to absorbing water, its rough, eroded and rocky condition also favors a rapid run-off. The imperative need is, therefore, a means of retarding the flow of the water until the soil has a chance to drink it up. The best means of affecting this is through a forest cover, which assists in many ways the accumulation of a reserve water supply. The

crowns of the trees break the force of the rain, making it reach the ground more slowly and giving it longer time to soak into the earth. The litter of the forest absorbs water and retards its runoff, thus not only preventing erosion, but giving the water further time to filter into the soil. The roots of the trees bind the earth together and help to prevent erosion. Finally, the shade of the tree canopy cuts off the rays of the sun, prevents intense heating of the rocks, and very materially lessens evaporation from

men there do not over-pasture their lands, but preserve a good grass cover, and if even the present forest areas are maintained, conditions may not grow rapidly worse for the plateau and the lowland agricultural section. Both these precautions are, however, not likely to be observed. Moreover, it is necessary not only to maintain the present forest cover, but all dry hills and rough breaks should be put under forest. As such work would not pay for itself directly, and as it must contemplate the advan-



CHARACTERISTIC VIEW OF THE TIMBER, MOSTLY MOUNTAIN CEDAR, ON THE EDWARDS PLATEAU, 20 MILES NORTHWEST OF AUSTIN.

the forest-covered area. This is an exceedingly important matter in a section of the country where the dry air can annually remove by evaporation over 50 inches of free water. Thus it is clear that a forest cover would not only prevent the erosion which is constantly making conditions worse, but it would also hold in check vast quantities of water which now run off in destructive floods, and assist in storing it for future gradual use in river and spring flow throughout the year.

The chief industry of the Edwards Plateau is cattle-raising. If the ranch-

tage rather of the distant farmer than of the neighboring ranchman, it will never be done by private means. It is distinctly a work for the State of Texas operating under a broad policy to build up its agricultural interests.

The Bureau of Forestry, through Prof. William L. Bray, has just completed a careful study of "The Timber of the Edwards Plateau; Its Relation to Climate, Water Supply, and Soil," and a bulletin dealing with the results, which are so vitally important to Texas, will be issued by the Bureau at an early date.

FOREST CONDITIONS IN WESTERN WISCONSIN.

BY

DR. L. H. PAMMEL,

BOTANIST, IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

WESTERN Wisconsin was once a heavily timbered section of the state, consisting of hardwoods and conifers. The region embraced in this article contains the following tributaries of the Mississippi: the Black and La Crosse rivers, and also the Kickapoo, which flows into the Wisconsin, the latter finding its way into the Mississippi below Prairie du Chien. The territory in this section of Wisconsin immediately contiguous to the Mississippi River is intersected by many smaller creeks. The valleys here have in a large part been cleared of their timber and converted into farms. There is comparatively little level land in the smaller valleys, but in the larger ones there is a greater proportion of land suitable for agricultural purposes. The soil in these valleys consists largely of a yellow loam, originally with a few inches of humus. The bottom lands consist of an alluvial material of greater fertility. Near the shore lines of the present flood plain of the larger streams there are considerable expanses of a light, sandy soil. The flood plain of the Mississippi, La Crosse, and Black rivers consists of a few inches of surface drift overlaid with sand. The amount of sand and drift, however, is variable in the smaller streams.

The region alluded to in this article is included mainly in the driftless area. During the Cambrian age there was a great accumulation of sandstone, and great deposits of this material may be seen as outcrops along the Mississippi River, but further in the interior, along the Kickapoo, the valleys are narrow and the sandstone outcrops are less conspicuous. The hills are not so high and the valleys are narrower. Overtopping the sandstone is a layer of magnesian limestone, varying in thickness from 30

to 70 feet. The soil overlying the limestone consists of a yellow clay mixed with humus on the surface. The soil has had an important influence in the growth and kind of forest trees occurring in the region.

EARLY HISTORY.

During the early days timber covered all of the valleys and hillsides except the dry upper slopes, and was uniformly thick on the north slopes. On the east slopes the timber was thinner, owing to frequent fires; consequently this timber was of poor quality. The north slope consisted mainly of red oak, white oak, hickory, basswood, and birch. Beginning along in the late 50's till in late 70's, much of the timber of the lower fertile slopes was removed and the land brought under cultivation. This land produced splendid crops of wheat, so long as the humus remained in the soil. After the removal of the humus by washing, the soil no longer produced remunerative crops, and it became necessary to change from the cultivation of grain to that of grass, largely because of the washings.

Later, clearings were started on the ridges. These contained a heavy growth of white and red oak, some hickory and basswood. The wood could not be sold, and in clearing the farmers cut the trees and burned them. Later wood was more in demand, when it was cut into ties or sold as cordwood. In the 80's good red oak or white oak ties sold from 18 to 25 cents, the best white and red oak wood from \$2.50 to \$3.00 a cord. The grain were the chief crops on these denuded lands. As a result of the removal of the timber and cultivation of the slopes, great gullies were washed, so that grain culture was

gradually abandoned and in its place the meadows made their appearance. The clearing has gone on until most of the ridges have been cleared, except small patches of timber, which may rightfully be termed the farmer's wood-lot. They vary from a few acres to thirty or forty, consisting mainly of second growth.

The growth may be seen from the following table:

SOIL, YELLOW SANDY LOAM.

Species.	Per cent
<i>Quercus alba</i>	24
<i>Quercus rubra</i>	11
<i>Quercus tinctoria</i>	19
<i>Carya alba</i>	20
<i>Populus grandidentata</i>	3
<i>Acer nigrum</i>	4
<i>Ulmus americana</i>	3
<i>Juglans cinerea</i>	16

The tree growth in the valleys of one of the smaller streams may be seen from the following table. The soil is a yellow loam with a good deposit of humus:

Species.	Per cent
<i>Quercus macrocarpa</i>	13
<i>Quercus tinctoria</i>	26
<i>Tilia americana</i>	25
<i>Acer nigrum</i>	7
<i>Juglans nigra</i>	15
<i>Fraxinus viridis</i>	6
<i>Carya amara</i>	8

Growth of trees on a sunny south slope, yellow clay soil:

Species.	Per cent
<i>Quercus tinctoria</i>	35
<i>Carya alba</i>	42
<i>Ulmus americana</i>	12
<i>Betula papyrifera</i>	11

On sandy alluvial drift, Pettibone Island:

Species.	Per cent
<i>Acer saccharinum</i>	42
<i>Populus monilifera</i>	8
<i>Ulmus americana</i>	34
<i>Betula nigra</i>	16

Black sandy drift soil along the Kickapoo in Hemlock grove:

Species.	Per cent
<i>Tsuga canadensis</i>	26
<i>Betula lenta</i>	31
<i>Betula papyrifera</i>	11
<i>Juglans cinerea</i>	15
<i>Acer nigrum</i>	12
<i>Quercus macrocarpa</i>	5

In western Wisconsin the following forest formations can be recognized:

1. The river formation.
2. The sandy upland.
3. The valley formation.
 - a. Uplands.
 - b. Bottoms.
4. The ridge.
5. The tamarack.

1. *The River Formation*.—The more important species found along the largest streams like the Mississippi, La Crosse, and Black are the following: Soft maple (*Acer saccharinum*), American elm (*Ulmus americana*), river birch (*Betula nigra*), green ash (*Fraxinus viridis*), cottonwood (*Populus monilifera*), almond-leaved willow (*Salix amygduloides*), swamp white oak (*Quercus bicolor*), and hackberry (*Celtis occidentalis*).

Table Showing Percentage of Species.

Species.	Per cent
<i>Acer saccharinum</i>	37.6
<i>Fraxinus viridis</i>	11.6
<i>Betula nigra</i>	12.9
<i>Populus monilifera</i>	9.3
<i>Ulmus americana</i>	15.9
<i>Quercus macrocarpa</i>	4.7

2. *The Sandy Uplands*.—The sandy uplands represent the ancient beaches. There is very little humus on the surface, the soil consisting of fine sand. The surface water penetrates very rapidly and dries out very soon. Several feet below the surface there is always moisture. The species of trees found here are neither abundant nor large, the trees usually being stunted, and occur in open groves. The following species occur: Scarlet oak (*Quercus tinctoria*), green ash (*Fraxinus viridis*), burr-oak (*Quercus macrocarpa*).

3. *The Valley Formation*.—The valleys consist of alluvial bottoms along the smaller streams with an upland for the most part of side hills. These hills are dry on the exposed sunny sides, while on the north slopes they are moist. Toward the base of the hills the soil is usually free from rocks, though near the top the soil is often very rocky. The soil near the bottom is a black alluvium mixed with a little sand. The upland consists of a yellow loam overlaid with a black sandy humus. Fol-



HILLS ONCE COVERED WITH TIMBER DOWN TO THE BANK OF THE MARSH. THIS HILL, HAS BEEN BADLY WASHED AWAY, OWING TO THE DENUDATION OF TIMBER IN THE VALLEYS ABOVE.

lowing are some of the percentages of the different trees at different places.
On State Road Coulé :

Species.	Per cent
Quercus tinctoria.....	48
Quercus alba.....	
Carya alba.....	27
Ulmus americana.....	10
Betula papyrifera.....	10
Negundo aceroides.....	2
Populus tremuloides.....	3

South and west and east slope, Kickapoo Valley, bank of stream :

Species.	Per cent
Acer nigrum.....	4
Crataegus tomentosa.....	1.5
Tilia americana.....	2
Betula alba.....	2
Juglans cinerea.....	10
Ulmus americana.....	8

Species.	Per cent
Tsuga canadensis.....	32
Betula lenta.....	35
Populus tremuloides.....	1.5
Quercus macrocarpa.....	2

The more important shrubby plants found here were *Corylus rostrata*, *Alnus incana*, on the banks of the stream, *Ribes cynosbati*, *Prunus virginiana*, *Rubus strigosus*, *Acer spicatum*, *Sambucus racemosa*, *Taxus canadensis*, *Cornus alternifolia*, and *C. circinata*. Of the herbaceous plants, *Mitchella repens*, *Pyrola rotundifolia*, *Epigaea repens*, *Adiantum pedatum*, *Ranunculus recurvatus*, *Mitella diphylla*, *Phegopteris dryopteris*, *Aralia racemosa*, *Sanguinaria canadensis*, *Campanula rotundifolia*, *Circaea alpina*, *Viola cucullata*.

Southeast dry slope Kickapoo River :

Species.	Per cent
<i>Prunus serotina</i>	9
<i>Populus tremuloides</i>	48
<i>Quercus macrocarpa</i>	18
<i>Quercus tinctoria</i>	21
<i>Ulmus fulva</i>	2
<i>Acer nigrum</i>	2

The shrubby undergrowth consists principally of *Cornus candidissima*, *Prunus americana*, *P. virginiana* and *Rubus strigosus*.

North slope Kickapoo River :

Species.	Per cent
<i>Acer nigrum</i>	20
<i>Acer rubrum</i>	4
<i>Populus grandidentata</i>	10
<i>Populus tremuloides</i>	2
<i>Betula papyrifera</i>	5
<i>Quercus alba</i>	2
<i>Quercus rubra</i>	5
<i>Quercus tinctoria</i>	7
<i>Quercus macrocarpa</i>	7
<i>Ulmus fulva</i>	12
<i>Tilia americana</i>	14
<i>Carpinus americana</i>	15
<i>Fraxinus americana</i>	2
<i>Prunus serotina</i>	1

The shrubby undergrowth consisted of *Amelanchier canadensis*, *Prunus pennsylvanicus*, *Corylus americana*, *Rubus strigosus*, and the herbaceous vegetation of *Actæa spicata*, var. *rubra*, *Mitella diphylla*, *Brunella vulgaris*, *Viola pubescens*, *Thalictrum dioicum*.

Table Showing Rate of Growth of Hemlock (*Tsuga canadensis*).

No. of tree.	Diameter in inches.	Height in feet.
1.....	33	64
2.....	36	50
3.....	$\frac{1}{2}$	8
4.....	$\frac{3}{4}$	10
5.....	1	12
6.....	$\frac{1}{2}$	10
7.....	$\frac{1}{2}$	10
8.....	$\frac{3}{4}$	10
9.....	6	30
10.....	8	40
11.....	10	50
12.....	14	40
13.....	21	45

The above table represents simply second growth. Most of the trees have appeared since the trees were cut thirty



A WOODLOT CONSISTING OF WHITE OAK, *Populus tremuloides*, AND *P. grandidentata*. THIS IS SITUATED IN VERNON COUNTY, WISCONSIN.

years ago. The larger were probably small trees when the ground was cut over thirty years ago. The smaller trees have grown an average of 7.2 inches in height and .1 inch in diameter per year. This is not a very good growth, but this species makes better progress after the first ten years than before.

Size of Cherry Birch (*Betula lenta*).

No. of tree.	Diameter in inches.	Height in feet.
1.....	12	40
2.....	1	10
3.....	1	10
4.....	1.5	12
5.....	2	14
6.....	8	40
7.....	14	05

The cherry birch grows quite rapidly and makes a good cover for the hemlock. The average increase in height for the years 1901-1902 was 12 inches.

Size of Other Trees.

Species.	Diameter in inches.	Height in feet.
<i>Juglans cinerea</i>	6	18
<i>Juglans cinerea</i>	3	18
<i>Juglans cinerea</i>	3	18
<i>Acer nigrum</i>	1.5	12
<i>Acer nigrum</i>	10	35

North slope of one of the branches of the Kickapoo River:

Species.	Per cent
<i>Pinus strobus</i>	27
<i>Tilia americana</i>	29
<i>Betula papyrifera</i>	9
<i>Quercus macrocarpa</i>	4
<i>Quercus alba</i>	4
<i>Quercus rubra</i>	3
<i>Quercus tinctoria</i>	1
<i>Carpinus caroliniana</i>	7
<i>Populus tremuloides</i>	1
<i>Acer nigrum</i>	9
<i>Prunus serotina</i>	3
<i>Crataegus tomentosa</i>	3

The shrubs found as an undergrowth of this formation consist chiefly of the following species: Hazelnut, *Corylus americana*; beaked hazelnut, *C. rostrata*; *Viburnum lentago*, *Salix humilis*, *Dier-villa trifida*, *Lonicera sullivantii*; on the more sandy slopes, dry exposed situations, the *Vaccinium pennsylvanicum*.

Of the herbaceous vegetation the following plants are more or less frequent: *Hieracium canadense*, *Mitella diphylla*, *Geranium maculatum*, *Dodecatheon meadia*, *Pteris aquilina*, *Oenothera fruticosa*,

Polygala senega, and *Comandra umbellata*.

The white pine occurring in this vicinity was cut many years ago, but a very good stand of second-growth white pine has made its appearance along with the deciduous trees. It consists, therefore, essentially of a mixed forest of white pine, white birch, oak, hornbeam, and quaking asp.

4. *The Ridge Formation*.—Originally the region was covered with a splendid growth of hardwood species. The timber here was very dense, and to make way for farms this fine timber was cut, put in large piles, and burned. Some of these ridges frequently contained solid bodies of either white or red or black oak; hence the common name white-oak ridge or black-oak ridge. Most of the original timber has long since been removed, although in a few instances some few areas are still remaining. The soil consists of a black humus on the surface from a few inches to a half foot in thickness. Underneath the humus is a yellow clay soil somewhat tenacious, but well adapted for the growth of forest trees. The soil, unless renewed by fertilizers or pastures, soon wears out, especially so since it is much subject to washing. During the last fifteen years enormous gullies have been formed, especially on the sides where the soil was cultivated. Such areas are certainly much better adapted for the growth of forest trees than for cultivated crops.

The percentage of different species of timber varies greatly, depending somewhat upon the character of the soil. As a sample illustration of the kind of plants that grow upon soils that are somewhat affected by the St. Peter sandstone, the following may serve as an illustration:

RIDGE HEAVY CLAY SOIL.

Species.	Per cent
<i>Quercus alba</i>	4
<i>Quercus rubra</i>	29
<i>Quercus tinctoria</i>	7
<i>Populus grandidentata</i>	32
<i>Carya alba</i> and <i>amara</i>	13
<i>Populus tremuloides</i>	14

In other instances the white oak may form 40 to 50 per cent of the growth of the native timber. In this case the soil



THE PRESENT METHOD OF HANDLING LOGS ON THE MISSISSIPPI RIVER. PHOTO TAKEN NEAR LA CROSSE, WIS.

is heavier. Such species as the red oak and black oak also grow in nearly solid bodies.

5. *The Tamarack Formation.*—There is comparatively little tamarack left in the region of western Wisconsin; the species *Larix americana* never was abundant in La Crosse and Vernon counties or in southeastern Minnesota. The writer knows of a marsh that is practically extinct in Huston county, Minnesota, and of several small marshes of 40 or 50 acres in extent in eastern La Crosse county along what is known as Mormon coulé; also another in the La Crosse Valley. These marshes were formed under somewhat similar conditions. Surrounding the marshes are low hills consisting of outcrops of Potsdam sandstone. The lower portions of this sandstone are highly retentive of moisture and form the base of the water-bearing surfaces. Surrounding these marshes

one finds considerable peat, and, in a few instances, regular sphagnum bogs. Commercially, the timber has been cut for fuel, posts and rails.

Taking up some of the other plants, we find that the sandstone bluffs usually contain considerable quantities of the *Juniperus communis*. This frequently also grows right into the marsh. It should be noted also that the same species is found upon limestone rocks. Then the white pine may or may not ac-

company the sandy formation surrounding the marsh.

Underneath the sandstone rocks such herbaceous plants as *Pellaea gracilis*, *Aspidium spinulosum*, *Woodsia ilvensis*, and *W. obtusa*, *Gerardia grandiflora*, and *Gaultheria procumbens*.

Of the shrubby plants *Vaccinium pennsylvanicum* and *Diervilla trifida*. Bordering the marshes we find *Salix candida*, *S. lucida*, *S. discolor*, and *S. rostrata*.

Where the swamps are being filled up the *Salix longifolia* is beginning to appear in great abundance. More scattered through the tamarack marshes we find *Cornus stolonifera*, *Pyrus arbutifolia* and *Nemopanthes canadensis*; also occasionally the *Cypripedium spectabile*, *Osmunda cinnamomea* and *O. regalis*. Occasionally on the borders of the swamps is found the red maple, *Acer rubrum*, which on the hills, however, is extremely rare in this state.



Bristow Adams

CAMP LIFE AT THE YALE SUMMER SCHOOL OF FORESTRY.*

BY

Q. R. CRAFT,

BUREAU OF FORESTRY.

“THE forest students have a better time and see more of the sights than the people who sit on the hotel verandas the greater part of the time,” remarked a Brooklyn young lady who spends the summer each year at Milford, Pa. It is invigorating certainly, a strenuous camp life, with daily tramps through the woods ten to thirty miles perhaps; in fact, any distance you like. The local press asserts that Pike county, of which Milford is the county seat, contains more lakes, brooks, waterfalls, and other attractions of picturesque and delightful scenery than any other county in the state, and enumerates forty-two points of interest in the county and the neighboring Shawangunk hills of New Jersey. Driving and automobiling are facilitated by the excellence of the valley roads, which are of a quality rarely found in this country except in the immediate environs of large towns. They are macadamized with the shale which abounds in cliffs along the streams, and are harder than an asphalt pavement and almost as smooth.

At Milford the murmur of waterfalls and the buzz of the sawmill take the place of the steam whistle. One of these mills in addition prepares excelsior, and another white oak chair material. Along the river road to Dingman's Ferry chestnut ties, cut from the woods which cover the hills between the two villages, are piled at convenient landings on the bank of the Delaware. These ties are seasoning to be in readiness for floating down the river to Trenton and Philadelphia. Outside of the flat alluvial land of the river bottom the whole region is a timber country, wild

and rugged, naturally abounding in fish and game, and for the most part unconquerable by the plow. A better place for a forest experiment station and summer school would be hard to find.

ADVANTAGES OF THE LOCATION.

The school is cheaply accessible on account of summer season round-trip excursion rates from all eastern cities to Port Jervis, N. Y., eight miles distant. With a few exceptions, the students live in a camp, which has a breezy and healthful location on the top of a hill about a mile west of the village. The tents are pitched in the edge of the woods, while the new buildings with the baseball grounds occupy a clearing on the brow of the hill. The abundance of cold spring water, and the famous Sawkill swimming pools, where one can “shoot the chutes” over one cascade, dive, and upon emerging be ready to go over the next, help to make this cool retreat one of the most attractive places in the country to take a summer outing.

The range in altitude (the cliffs which bound the valley rise almost sheer, sometimes for about 300 feet, broken by deep gorges, through which tumble foaming streams that drain the bordering plateau) and the composition and water content of the soil are conditions which make possible the growth of an unusually large number of the trees and shrubs of the eastern United States. Added to these are the numerous species from the West and from Europe and Asia, planted on Mr. Pinchot's spacious grounds. Further opportunity is given for comparison of the growth, appearance, and habits of related spe-

* Illustrations by courtesy of Walter O. Filley.

cies, both native and exotic, in the nursery and plantation of the Forest Experiment Station, situated just east of the large walled garden at Grey Towers.

THE DAY'S WORK.

The Summer School of 1904 was attended by representatives of prominent scientific schools and colleges and by other men who, in their employments, found the urgent need of a more practical and accurate knowledge of the woods. There was no more earnest pupil than a retired physician, who wished to become his own forester on his timber tracts in southern New Jersey and western Massachusetts. Those with whom the writer talked had read Schlich's Manual of Forestry or other literature dealing with forest problems, but no amount of text-book study could compare in results with the first-hand knowledge obtainable through the field instruction combined with lectures, which constitutes the method of the Summer School.

During the past summer Prof. James W. Toumey, director of the Summer School; Mr. Arthur H. Graves, and Mr. Edward E. Carter were continuously

present, and the classes were so arranged that every hour was well occupied.

Following the morning lectures at 8.30, given in Stone Cottage, a pretty example of Swiss architecture, the classes, accompanied by their professors, take a tramp through the woods to prove by observation the facts they have learned and to do practical work under the eye of the instructor. When Mr. Carter launched the class upon a steep hillside and called on its members to tell, unsupported by any volunteered suggestion, how the instruments by which accurate height measurements are mathematically obtained should be employed, it was amusing to compare the different methods proposed by the tyro foresters.

No less perplexing were some of the tests in identification of forest species, as when Mr. Arthur Graves in one of his "examinations" pointed out twenty-five trees as he strode through the woods, calling on the class without collusion to write the common and botanical name of each. The list included three trees of widely varying appearance, yet of the same species—a small red cedar with needle-shaped leaves,



DINING HALL.

JUNIOR HALL.

CLUB HOUSE.

THE NEW BUILDINGS.



AN ATTENTIVE CLASS TO A FIELD DEMONSTRATION.

and also small sweet and yellow birches, distinguishable mainly by taste. Or take the program of a day with Professor Toumey's class. After the early morning lecture on the relation of rocks to silviculture, all walked across the Delaware River bridge into New Jersey, to observe the tilted strata of limestone, the character of the dark-colored soil it forms, and the greater luxuriance of its vegetable growth compared with that on the disintegrated shale on the other side of the river. Recrossing to the Pennsylvania side, the class followed the gorge of the Sawkill at the water's edge, observing the layers of shale, until it reached the still poorer land abounding in boulders of Catskill sandstone and other stone of the glacial drift, Professor Toumey directing especial attention to the effect of weather, water, and tree roots in hastening the breaking up of the rocks, and similar matters.

In the afternoon field work in forest mensuration or laboratory work in the identification of plants occupies the time, except on Wednesday and Saturday half-holidays, when baseball reigns supreme. The swim before supper is seldom missed.

In the evening a bonfire is kindled in the open court of the camp, and experiences of the day are exchanged, which provoke the recital of similar adventures in the widely separated regions from which the students are gathered. Mr. Gifford Pinchot attended one of these informal gatherings, and spoke concerning the government forest-reserve policy, the importance of state forest maps in controlling forest fires, the present attitude of cattlemen and sheepmen in regard to grazing on the reserves, and current work of the Bureau of Forestry. Association with the professors around the camp-fire is enjoyed by the students, and is of much practical benefit. Then, with the class yell of "Ban-zai, Ban-zai" (the Japanese war cry, learned last summer from the Jap camp cooks), all would retire to a well-earned night's sleep.

YALE FOREST STUDENTS AT MILFORD.

To give more thorough training in forest mensuration and silviculture, a summer term was this year added to the first year of the regular two years' course at Yale. This is separate and distinct in both lectures and field work from the Summer School. Like the

Summer School, this term opens July 1, but it continues thirteen weeks, instead of seven. The presence of the Juniors not only doubles the number of men in camp, with consequent quickening of general activity and friendly rivalry in both scholarly and athletic attainments, but it brings the Summer School students in contact with those who are

Carter, instructor in forestry, and by Mrs. Miller, secretary and librarian.

Part of the work of the Junior class the past summer was the felling of pitch pine on the Kinkel estate. Data were at the same time secured for a monograph on pitch pine, similar to that prepared in part in the same vicinity some years ago for white pine. More

figures will probably be secured by similar treatment of a tract of 70 acres bought by Mr. Pinchot.

The forest of the Pinchot estate was divided into squares by the Senior class of the Yale School in their surveying last spring. These squares will assist in locating sample plots on which to make periodically measurements of growth. On the white pine slope between the garden and the Sawkill River bridge each tree of the different species has been numbered and otherwise marked with red paint for identification. This is the first of a number of permanent plots to be established here and in other representative regions.

It was a red-letter day for the cause of forest education when Mr. James W. Pinchot gave the Yale Forest School a summer home on his estate at Milford. The people of the village welcomed its coming, and have watched with much satisfaction the erection of the club house, Junior hall and dining hall, which now house the school. In

the village a stone building is being erected by Mr. Gifford Pinchot, to be known as Forest Hall. This will be used for the illustrated lectures, which are open to the public.

LOCAL INFLUENCE OF THE SCHOOL.

Along the Delaware River the destructive effects of the March floods are



SAWKILL SWIMMING POOLS.

entering the profession of forestry and who for the most part have seen a great deal of life in the open.

Professor Graves was very busy, directing the studies of the Juniors, preparing manuscripts relative to forestry, and conducting the correspondence connected with the administration of the school. He was ably assisted by Mr.

still apparent in the débris upon some fields, the deep gullies in others, and the absence of bridges. The new wagon bridge at Port Jervis has just been completed, the crossing the past summer having been made by ferry. The driver here points out the spot where on the old bridge two spectators were viewing the magnificent spectacle when the ice raised the bridge from its foundation and hurled the men to death in the icy water. "These floods," he said, "are worse than years ago, because so much timber has been cut on the upper waters of the Delaware." And driver and passengers alike condemn the removal of the timber from a hillside near the Halfway House to supply the demands of a sawmill.

Indeed, the sentiment of forestry pervades the air in Pike county. The students are everywhere welcomed to fields and lawns, and the prohibitive signs to hunters and fishermen are evidently not intended to restrain the movements of the young foresters. One day a party was studying forest insects in the woods belonging to Monsieur Ragot, the sculptor. The sound of so many axes soon brought a number of ladies from "The Hermitage" to the spot with the inquiry, "Who gave you permission to cut those trees?" When they learned the mission of the choppers, the committee retired, saying, "That's all right. Go right ahead. You know what trees to cut, and what not to cut."

TWELFTH IRRIGATION CONGRESS.

OFFICIAL CALL FOR THE TWELFTH NATIONAL
IRRIGATION CONGRESS TO BE HELD AT EL
PASO, TEXAS, NOVEMBER 15 TO 18, INCLUSIVE.

ALL who are interested in conserving the great natural resources of the country, extending the habitable area, increasing the products of the land, insuring greater stability of prosperous conditions, making occupations upon the land attractive, the extension of internal trade and commerce, and a wider knowledge of a great economic movement, which has for its ultimate object the upbuilding of an empire within the borders of a great nation, are invited to attend this Congress.

The organization of this Congress will be as follows:

The permanent officers of the Congress, including the chairmen of the sections.

Members of the United States Senate and House of Representatives.

Governors of states and territories.

Ambassadors, ministers, and other representatives of foreign nations and colonies.

Members of state and territorial irrigation commissions.

Ten delegates, to be appointed by the governor of each state and territory.

Four delegates, to be appointed by the mayor of each city of more than 25,000 population.

Two delegates, to be appointed by the mayor of each city of less than 25,000 population.

Two delegates, each duly accredited by any chamber of commerce, board of trade, commercial club, or other commercial body.

Two delegates, each duly accredited by any regularly organized irrigation, agricultural, or horticultural society.

Two delegates, each duly accredited by any regularly organized society of engineers.

Two delegates, each duly accredited by any agricultural college or college or university having a chair of hydraulic engineering, forestry, or other subject related to the general purpose of the Congress.

It is respectfully suggested that in the appointment of delegates persons should be selected who are sincerely interested in and purpose attending the Congress, and that appointment be made as early as possible.

Please have full name and post-office address of delegates mailed to Executive Chairman, Twelfth National Irrigation Congress, El Paso, Texas, that they may receive special information, which will be mailed to each delegate not later than October 5, 1904.

The work of the Congress has been so greatly enlarged through the increased interest in matters pertaining to irrigation that the Executive Committee have decided to systematize the work of the next Congress according to the provisions in articles 3 and 5 of our Constitution; consequently the work of the Twelfth Congress has been divided into five sections.

Each section will be conducted by a chairman, who will be recognized as an eminent authority in his line, which insures a thorough exposition of the respective subjects through the presentation of papers, addresses, and discussion by the most eminent men interested in forestry, irrigation, climatology, and their correlated subjects.

It is confidently predicted that the coming Congress will be more highly instructive and entertaining than any Congress which has preceded it.

El Paso, the western metropolis of the Lone Star State and on the border line of Old Mexico, is making preparation for the largest Congress, in point of attendance, which we have ever held.

A general committee of its ablest citizens, supported by the unanimous sentiment of the city, is arranging a program for the entertainment of the delegates which would require too large a space to print in this call, but is so unique in character as to be interesting and enjoyable to all.

A comprehensive exhibit of the products of irrigation will be installed adjoining the great Convention Hall, especially constructed for this Congress.

Irrigation in various phases will be

shown, which will include mechanics and electrical machinery and appliances.

Ample hotel accommodations can be assured to every delegate.

Special railroad rates have been made to apply from all parts of the United States to this Congress, the rates being the lowest ever made to any convention.

All newspapers and other publications are earnestly requested to give wide publicity to this official call and to impress upon their readers the far-reaching importance of this Congress.

The vice-president and members of the Executive Committee for each state are urged to make the provisions of this call as widely known as possible and insure the largest possible delegation from their respective states.

Every state in the Union is vitally and directly interested in the subjects to be discussed in the coming Congress.

In the various sections information will be dispensed regarding the increasing of production by irrigation in the Atlantic states, as well as in the Pacific section, forestry problems in New England and along the Appalachian chain, as well as along the Rockies and Sierras, engineering applied to protect from the devastation by floods, drainage of the submerged areas, directing and conducting the water to its most beneficial use, climatology, with special reference to the service of the Weather Bureau throughout the United States and rural settlement, with special reference to the disposition of the surplus man.

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By C. B. BOOTHE, *Chairman*.

H. B. MAXSON, *Secretary*.

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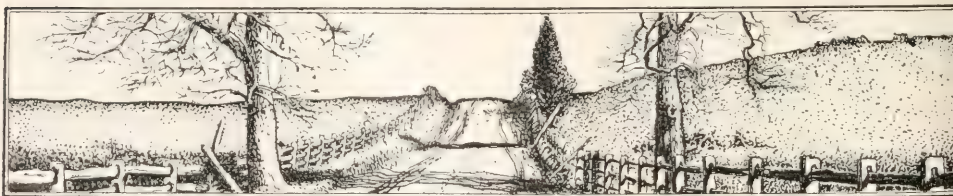
By W. W. TURNEY, *Chairman*.

A. W. GIFFORD, *Secretary*.

Approved:

W. A. CLARK,

*President and ex-Officio Member
Executive Committee.*



FOREST FIRES.

THE PAST MONTH HAS WITNESSED MANY
DISASTROUS FIRES IN THE NORTHWEST.

MONTANA, Oregon, and Washington have suffered severely from forest fires since the publication of our last number. Long-continued drouth, coupled with a very hot summer, have made conditions very favorable for fires. The fires reported from Washington do not appear to be in the same territory as those included in our last month's record, although generally widespread in occurrence. Fires started on the western shore of Vashon Island and near Lester, Washington, early in August, the latter fire proving one of the most serious in the state so far this season. The country south of Priest Lake and in the federal reserve 13 miles from Port Angels and near Lake Whatcom was also visited by fires more or less severe.

By prompt action large damage was averted from a fire near Foster, Washington, and near Colville ground fires destroyed crops of wheat and grain. Large quantities of dry underbrush gave foothold to a fire a short distance from Issaquah, which menaced several power plants and held up trains on the Northern Pacific, while at one time the destruction of several miles of snowsheds and several bridges along that railway were in danger from a blaze at Hot Springs. In Pierce as well as King county smouldering fires gained headway and gave trouble, while a shingle mill and dry kiln at Van Zandt were destroyed. A child 7 years old was severely burned in attempting to escape from a forest fire in Stevens county, and careless ranchers who neglected to extinguish log-heaps were responsible for a fire that penetrated into the city limits of Seattle and destroyed considerable lumber and standing timber.

Locomotive sparks started a blaze in valuable timber land two miles west of Barlow Pass, on the Monte Cristo Railroad, which damaged one of the Northern Pacific Railroad's bridges before it was put out. In the Copper Canyon Valley of the Olympics, the famous

game country, much trouble was experienced in subduing several fires which threatened to assume serious proportions. At Vancouver, Washington, soldiers from the barracks assisted in quelling a fire at Fourth Plain, which destroyed a lumber mill, seven houses, and cut lumber, inflicting in all damage to the extent of \$20,000, not including the standing timber destroyed. One man is under arrest for alleged incendiarism in connection with this fire, which has rendered twelve adults and twenty-three children homeless. On the Great Northern line, near Index, several days were required to extinguish a fire which caused considerable damage. In addition to these forest fires mentioned, hundreds of others, whose field of damage was only local or inconsequential, inflicted damage in practically every county of the state.

A fire which started in the latter part of July has, it is estimated, destroyed some 5,000 acres of timber in Montana, in the territory adjacent to Kalispell, and has required the combined efforts of forest rangers and a force of men placed at their disposal by the Great Northern Railroad to prevent its spread. On August 21, however, a severe rainstorm occurred, which, it is said, has practically extinguished most of the fires in this section. At Bonita, some 24 miles east of Missoula, a forest fire of considerable magnitude was discovered on August 12, and at Belton, within the limits of the Flathead Forest Reserve, a spark from a passing engine is supposed to have originated a blaze in the last week of July, which is said to have destroyed considerable valuable timber. At Athens, 17 miles west of Kalispell, a forest fire of about the same date destroyed hundreds of acres of patented land owned by the state and the Northern Pacific Railroad Company. Valuable pine timber was damaged by a fire near Columbia Falls, and at Whitefish set-

tlers narrowly escaped with their lives, losing homes and farm buildings. Dense smoke, arising from the burning of underbrush and green timber at the head of Ten Mile Creek, in close proximity to mining camps, forced miners and prospectors to abandon them.

A campfire left burning by berry-pickers in Linn county, Oregon, near Lebanon, is said to have originated a forest fire, which by August 18 had destroyed a shingle mill and devastated over 30 square miles of valuable timber, spreading over a large part of the county. In the Willamette Valley forest fires in scattered localities caused considerable uneasiness and damaged a large amount of timber. Scattered fires in Douglas county required attention on August 19, but little damage is reported to have occurred.

At Junction City, in Shasta county, California, a forest fire was reported on August 17 to have inflicted considerable damage, and Siskiyou county has had some loss through three small fires. On Bear River, in Placer county, a forest fire early in the month burned out the Rising Sun hoisting works, a stamp mill, powder mill, and office building, besides destroying several hundred cords of wood, and for a time a fire in Lytle Creek Canyon, near San Bernardino, threatened the safety of some of the big power plants supplying that city with electricity and water. At Nevada City, in Nevada county, and at Loyalton, in Sierra county, incipient forest fires occasioned minor damage.

Forest rangers in Wyoming succeeded in stamping out two forest fires which threatened to become disastrous before considerable damage ensued. They occurred in the Wind River Mountains, near Lander, and at Pinedale, near Fremont Lake.

On the north fork of Cœur d'Alene River, in Idaho, numerous forest fires, principally of minor importance, destroyed a limited extent of timber in the first week of August, and a continuation of the fires near the state line of Washington also inflicted damage.

Apropos of the prevalence of forest fires on the state boundary line between Washington, Idaho, and Oregon, it is

interesting to note also the destruction by forest fires in British Columbia, where immense damage has been done. In a dispatch to the *Chicago Record-Herald* four lives are reported lost through a fire near Vancouver, and the loss is placed as high as \$60,000,000. Along the entire eastern side of Vancouver Island forest fires were burning on August 20, and near Victoria great damage is reported to the standing timber. On Valdez Island a clean swath has been cut by the flames, and it was said that the whole of Hornby Island was ablaze. At East Kootenay fires of large magnitude were reported, and at Fernie over \$200,000 worth of valuable timber was destroyed, including the whole season's cut of logs, and the destruction of several mills narrowly averted.

Reports from Camborne, in the Kootenays, indicated a loss of \$25,000 through destruction of mining buildings, offices, mills, etc. On August 19 Wellington, B. C., was in danger of complete destruction, and grave danger was apprehended from the close proximity of a large powder magazine to the path of the flames. It is understood that much property was destroyed in the town's outskirts. Nelson, B. C., was threatened in a like manner. The Canadian government also suffered through the destruction of 20,000 railway ties in a large bush fire in the Temiskaming district of Ontario, while in Newfoundland renewed outbreaks of forest fires destroyed valuable timber. It is stated by the Canadian press that so far this season \$20,000,000 worth of timber has been destroyed in the interior of Newfoundland by forest fires, and the fires in British Columbia are pronounced the most destructive since 1896.

Outside of a small forest fire near Verdi, Nevada, and one of inconsiderable magnitude on the Gila River Forest Reserve of Arizona, no further fires have occurred in the West, and, so far as newspaper reports show, no fires of any magnitude have occurred in the eastern half of the United States, except near Gaylord, Michigan, where some damage to buildings and crops was sustained late in July.

Foresters and Inspectors Wanted for the Philippine Forestry Bureau

The salaries of Foresters, Assistant Foresters, Inspectors, and Assistant Inspectors range from \$1,200 to \$2,400 per year. Actual and necessary traveling expenses to and from the scene of field work are allowed, and while in the field one dollar gold per day is allowed for subsistence.

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The work of the Foresters is, to a large extent, technical; that of the Inspectors more administrative and less technical.

Examinations will be held in different parts of the United States about July 1 and November 1. For detailed information apply to the Bureau of Forestry, Washington, D. C., or to the Bureau of Insular Affairs, War Department, Washington, D. C.

Foresters and Inspectors now in the Philippine forest service and having from two to three and a half years' service, find the work very attractive, instructive, and healthful.

Copies of the Philippine Civil Service Manual may be obtained from the Bureau of Insular Affairs, War Department, Washington, D. C.

The reports, bulletins, and other publications of the Philippine Forestry Bureau should be read by all desiring to enter the service. Copies may be obtained by addressing the Forestry Bureau, Manila, P. I.



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DEPARTMENT OF THE INTERIOR, U. S. GEOLOGICAL SURVEY, RECLAMATION SERVICE, WASHINGTON, D. C., August 16, 1904. Sealed proposals, in duplicate, will be received until 10 o'clock a. m., September 22, 1904, at the office of the U. S. Reclamation Service, Chamber of Commerce Building, Denver, Colorado, for the construction and completion of a telephone system about twenty-eight miles in length, in connection with the Uncompahgre Valley Reclamation Project, near Montrose, Colorado. Specifications, forms of proposal, and particulars may be obtained after August 20, 1904, by applying to A. L. Fellows, U. S. Geological Survey, Chamber of Commerce Building, Denver, Colorado, to the Engineer of the U. S. Reclamation Service, Montrose, Colorado, or to the Chief Engineer of the U. S. Reclamation Service, Washington, D. C. Each bid must be accompanied by a certified check payable to the order of the Secretary of the Interior for 2 per cent. of the contract price as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of 50 per cent. of the contract price for the faithful performance of the work. The right is reserved to reject any and all bids and to waive technical defects if the interests of the Government require it. Bidders are invited to be present. Proposals must be marked "Proposals for telephone system, Uncompahgre Valley Project, Colorado." THOS. RYAN, Acting Secretary.

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DEPARTMENT OF THE INTERIOR, UNITED STATES GEOLOGICAL SURVEY, RECLAMATION SERVICE, WASHINGTON, D. C., JULY 29, 1904. Sealed proposals, in duplicate, will be received at the office of the U. S. Reclamation Service, at Montrose, Colorado, until 10 o'clock a. m., October 5, 1904, for the construction of the Gunnison Tunnel and approaches, involving 30,000 linear feet, more or less, of tunnel and about 120,000 cubic yards of excavation in open cut at the lower portal, the same being a portion of a system for the diversion of about 1,300 cubic feet of water per second from the Gunnison River to the Uncompahgre Valley, Colorado. Specifications, form of proposal, and plans may be inspected after August 10, 1904, at the office of the Chief Engineer of the U. S. Reclamation Service, Washington, D. C., at the office of the District Engineer, U. S. Reclamation Service, Chamber of Commerce Building, Denver, Colo., or at the office of the U. S. Reclamation Service, Montrose, Colo. Each bid must be accompanied by a certified check for \$10,000, payable to the Secretary of the Interior, as a guaranty that the bidders will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of \$150,000 for the faithful performance of the work. The right is reserved to reject any or all bids, and to waive technical defects, as the interests of the service may require. Bidders are invited to be present. Proposals must be marked "Proposal for the construction of the Gunnison Tunnel, Uncompahgre Valley Project." THOS. RYAN, Acting Secretary.

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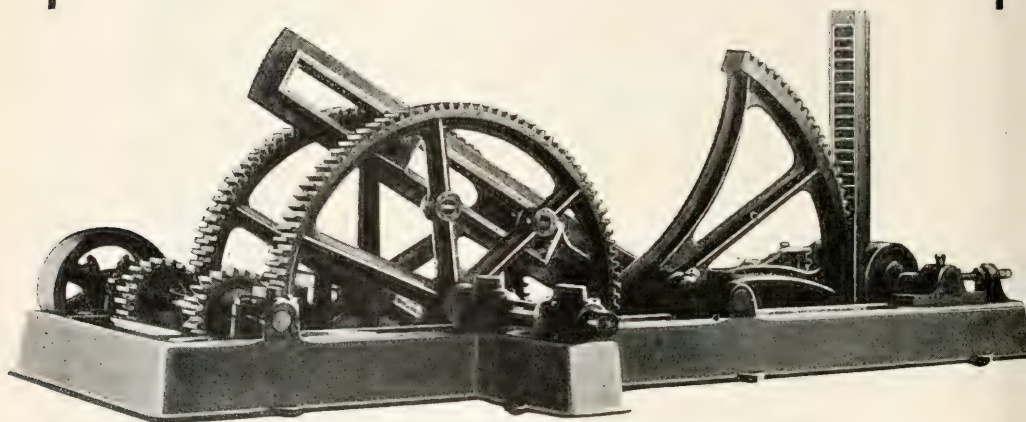
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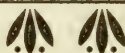
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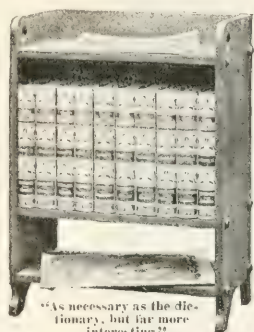


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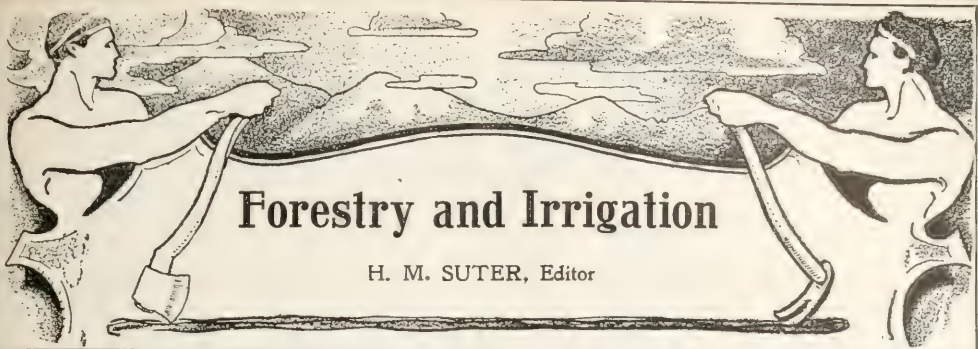
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SCENE SHOWING THE AFTER DESTRUCTION OF THE

Forestry and Irrigation.

VOL. X.

OCTOBER, 1904.

NO. 10.

SPECIAL ANNOUNCEMENT

AN

American Forest Congress

WILL BE HELD AT

Washington, D. C., January 2-6, 1905

UNDER THE AUSPICES OF THE

AMERICAN FORESTRY ASSOCIATION

This Congress is called to consider the forests in their relation to the great industries closely dependent upon them, such as lumbering, transportation, irrigation, mining, and grazing, and to forward the conservative use of the forest resources of the country, to meet the present and future needs of these great industries.

That this Congress is of national importance is shown by the fact that the President of the United States will address it, and has promised to receive its delegates; while the presence of many of the foremost men of our industrial life at its sessions assures definite and far-reaching results from its deliberations.

Altogether, this Congress promises to be the most notable event the forest movement in this country has known. Delegates will be present from the government bureaus having forest and irrigation work in charge; from the various lumbermen's associations; mining, stockmen's, and woodworking associations; engineering societies, and many other representative organizations.

The attendance promises to be the largest that has ever been present at a meeting devoted to forest subjects in this country. The official call for the Congress will be issued by the American Forestry Association in November; arrangements for special railroad rates are in progress, and information on this point, as well as on hotel and other matters, will be announced at an early date by the committee in charge.

NEWS AND NOTES.

Louisiana Forest Law. The last session of the Louisiana legislature passed an act to establish a department of forestry to provide for the preservation of the forests, to prevent and suppress forest fires, and see to the reforestation of denuded lands.

It provides that the register of the state land office shall be commissioner of forestry, with an addition of \$500 in salary. With him four other citizens, serving without compensation, constitute the state forest commission, which shall see to the administration of the act. The act provides for fire wardens in the various counties of the state and a chief fire warden to personally superintend forest-fire control, at a salary of \$500 a year and his expenses. He is empowered to spend not to exceed \$5,000 per year for fire control, as he sees fit, for fire patrol and prevention in other ways. The parish fire wardens are to receive \$2 a day for time spent in this work—two-thirds from their parish and one-third from the state. The fire wardens are empowered to call upon all citizens to assist them in times of fire or danger of fire. Willful, negligent, or careless setting of forest fires that cause injury are punishable by a fine of not over \$500 or imprisonment for not over ten years, or both.

The law further provides that leaving camp-fires unquenched, using combustible wads in firearms, or carrying naked torches in forests shall be punished, whether injury result or not, by a fine of not more than \$100 or imprisonment for three months. The same penalties hold for defacing warning placards. Railroads are required to clear their right of way 50 feet on each side of their lines. Under this act Mr. A. W. Crandall becomes the commissioner of forestry.



Fire Control in California. The rains of last September throughout California practically closed at an early date the season of forest fire

danger in the state. They also brought to a successful culmination the first season's application of the plan of fire protection prepared by E. A. Sterling, of the Bureau of Forestry, for the California timber lands of the Diamond Match Company.

This plan, in addition to an annual systematized burning of the slash, provides for a system of trails and telephones whereby all fires may be reached and reported promptly, a lookout station at a sightly point, a regular patrol during the dry season, the posting of warning notices, the storing of fire-fighting tools at convenient points, and the working up of an anti-fire sentiment among the local inhabitants. There has also been a picked crew kept in readiness during the season to drop all other work and proceed immediately to the scene of the fire. The field work during the summer has been under the charge of B. J. Teasdale, who entered the company's service from the Bureau to act as fire warden.

All of the proposed trail and telephone lines were not completed this season, but the more important ones were finished, and the remainder will be put in next year. A regular patrol was maintained and a close watch kept of campers and others within the tract. The change in the sentiment of the local inhabitants during the year was very marked. From an attitude of indifference to fires they have come to look upon them as an evil, and not only exercise great personal care, but promptly report all fires seen or heard of. The season has ended without a serious fire on the match company's land, although extensive fires occurred on adjacent timber land.

In general, the fire season in California has been a serious one, as will be seen from our notes on September fires printed elsewhere in this number. As is usual, many fires were burning in the Sierra forests which were never reported. In Tehama county two large fires burned for over a month prior to the rains, but mostly in the chaparral

and open forest of an uninhabited region; hence no attention was paid to them. Near Sims, on the line of the Southern Pacific, and at various points in Shasta county, troublesome fires have existed. The two most serious fires, and the only ones given much newspaper space, occurred in the region adjacent to San Francisco Bay. One was in Marin county, near San Rafael, and for a time threatened the Mt. Tamalpais Railway and tavern; the other burned over a large area and destroyed much property in Santa Cruz county, and only by strenuous effort was kept from running through the state Redwood Park in the Big Basin.



Pennsylvania and the Fair. The following letter from Dr. J. T. Rothrock, until recently Commissioner of Forestry for Pennsylvania, explains why his state made no forest exhibit at the World's Fair:

Editor Forestry and Irrigation.

SIR: Mr. Alfred Gaskill's comments on page 404 of September issue of your journal are both natural and proper. He writes thus: "Far more significant is the failure of such leading states in the forestry movement as Pennsylvania, Maine, and Minnesota to show what they have done to maintain and extend their woodlands." It simply remains for Pennsylvania to say that at the time when application was made for space there were but 900 square feet available and we required at least 2,500 square feet in which to make suitable exhibition of what was doing here in forestry. We thought that no display at all was better than an inadequate one.

Individually, I have long believed that Pennsylvania could use the money available for forestry purposes to better advantage than by taking part in these constantly recurring expositions, to meet the demands of which attention and funds must be diverted from more productive work. However, out of respect to public opinion, Pennsylvania was prepared to have made a forestry exhibit if space could have been obtained.

In what has been said there is intended no suggestion of the unwilling-

ness on the part of the authorities to accord the room desired if it had been available.

J. T. ROTHROCK.



Studying Underground Waters.

Mr. Charles S. Slichter, engineer, U. S. Reclamation Service, who recently conducted the investigation of the underflow in the Arkansas River Valley in western Kansas, is now engaged in similar work in the vicinity of El Paso, Texas. A brief reconnaissance indicated that there could be no underflow of any consequence at the narrows of the Rio Grande above the city. At the site of the proposed international dam the distance between the walls of the gorge is less than 400 feet, and the Mexican borings seem to indicate that bed rock is reached at about 86 feet at deepest point. The limited cross-section of less than 40,000 square feet could not transmit a large volume of ground water, even if other conditions were favorable. The highest velocity ever determined for ground waters is 100 feet per 24 hours. Assuming this maximum velocity at the above cross-section and a porosity of one-third, the daily discharge would be 1,333,000 cubic feet, or $15\frac{1}{2}$ second feet. The gradient of the water plane at the narrows is but 4 feet to the mile, and all other indications point to a low rather than a high velocity.

There are none of the common and usual indications of an underflow at this point. If a free underflow existed, a perennial stream would undoubtedly exist in the narrow gorge above El Paso. In addition to a perennial surface flow through the narrowest portion of the gorge, above the gorge and near its converging sides the ground water should have a slightly artesian character; but none of these indications were found to be present.

Notwithstanding the above considerations, work was begun to determine the actual rate of underflow. In the coarsest strata of sand met with in drilling the wells the velocities were found to be between 2.7 and 2.9 feet per 24 hours.

An important fact brought out by the investigation is the increasing hardness

and saltiness of the water in the sand of the gorge with the depth penetrated. The increase can be noted from foot to foot. At a depth of 42 feet the water contains about 1,200 parts per 100,000 of common salt—not quite as strong as sea water.

Mr. Slichter examined the situation below El Paso with reference to the possibility of ground-water supply from wells. The mesa east and north of the city contains a very fine water-bearing sand at a depth of about 180 feet. The stratum is between 30 and 60 feet thick, and the material is too fine for good wells. At the southern boundary of this mesa the river runs at the present time about 40 feet higher than the top of the above-mentioned water-bearing sand. There is every indication that at the time the river cut the gorge above the city to the depth of 86 feet it cut into this deposit of sand and resorted and redeposited the material, carrying much of the finer material away. For this reason good wells can be had along the entire edge of the mesa wherever the river has done its work, except in a few instances where the river carried away all the sand and left a local deposit of clay and mud in its place. By running levels it was determined that the water plane slopes both from the mesa and from the river toward the region where water is being extensively pumped for irrigation. The water plane is about 2 to 3 feet below the surface of present running water in the river, indicating that both the river and the mesa contribute to the ground water taken from the wells. The river probably does not furnish much water to the sand on account of silt, except in times of flood, when the scour is deep.

This work, which is of the utmost interest and importance to citizens of the valley, will be carried forward as rapidly as possible, and will include an extension of the work to Las Cruces, New Mexico.

Irrigation Congress.

Judging from the widespread interest exhibited, the Twelfth National Irrigation Congress, to be held at

El Paso, Texas, November 15-18, promises to be the most successful yet convened. Mr. A. W. Gifford, who is secretary of the Southwestern Irrigation Association, and who has been actively working to secure full representation, has just returned to El Paso from a trip through California, undertaken with the object of stimulating interest in the Congress. He expresses great gratification at the general enthusiasm manifested, and states that hearty coöperation is promised by some of the most influential organizations and citizens of California. Mr. C. B. Boothe, executive chairman of the Congress, reports that Governor Pardee, of California, will head a strong delegation from that state.

President Diaz, who has evidenced a desire to attend the sessions of the Congress, has been sent, by messenger, a special invitation, signed by Senator Clark, as president of the Congress.

It is gratifying to observe the interest shown in the Congress, as evidenced by the hearty coöperation of those interested in irrigation throughout the West, and numerous exhibits will be made by fruit-growers and irrigators in general. California, Utah, Washington, Texas, and Nevada are to be represented by large delegations, and all previous records in attendance promise to be eclipsed.



Absaroka Forest Reserve. The Absaroka Forest Reserve of Montana was merged with the Teton and the Yellowstone forest reserves by proclamation of January 29, 1903, the whole taking the name of the Yellowstone Forest Reserve. The forest conditions in the Absaroka division of the reserve have been studied by Mr. John B. Leiberg, of the U. S. Geological Survey, which organization recently issued a bulletin on the subject.

As an introduction to the main subject, Mr. Leiberg gives a general description of the topography, drainage system, rock formations and soils, mining areas and minerals, agricultural lands, grazing lands, and lakes and tarns found in the Absaroka division of the reserve.

The forest in the reserve is almost

wholly coniferous. The trees are of greatly different ages. Stands 15 to 20 years old are associated with growths 75 to 100 years of age and with veteran stands 200 to 300 years old. This condition has been brought about by fire, the stands of different ages marking burns of different periods.

The timber in the reserve, which is valuable for commercial purposes, may be divided into two classes, that of sufficient dimensions and suitable qualities to furnish saw-logs, and that fit only for fuel, fencing, poles, railroad ties, and mine props. Owing to the preponderance of the lodgepole pine, with its slender, pole-like growth, and the generally low, stocky stature of the other species of trees, mill timber is scarce. Most of it is obtained, however, from the lodgepole pine, because that tree is accessible and abundant and uniformly distributed over the areas that have the most favorable climatic and soil conditions.

Next in volume comes the Engelmann spruce, which is little used either for mill timber, fuel, or fencing material, because the heaviest and best stands of the species occur in localities remote from transportation or demand. The red fir ranks next. Little of it is utilized, however, as it usually grows on rocky, steep slopes whence there is no means of transporting it to the outside world. The white pine and yellow pine form only an inconsiderable portion of the mill timber. The yield of mill timber varies from less than 1,000 feet, B. M., per acre in the higher areas and in the tracts adjacent to the foothills to 10,000 feet, B. M., on the tracts embraced in the Davis Creek and Middle West Boulder River bottoms, the Slough Creek bottoms, and portions of Buffalo Creek Valley. Notwithstanding rocky and comparatively barren soil, the region is capable of sustaining at least twice the amount of timber it now carries if fires were totally suppressed, grazing and cutting restricted, and sheeping absolutely prohibited.

Mr. Leiberger also includes a report on the Livingston and Big Timber quadrangles of Montana, which contain parts of the Absaroka division of the Yellow-

stone Forest Reserve. The examination was made primarily in order to classify the lands and estimate the timber within the boundaries of the reserve, but the land was classified and the timber estimated beyond the reserve boundaries in order to include all of the Livingston and Big Timber quadrangles.



Good Plank for Any Party. The following request for a plank in the Democratic state platform favoring needful forest legislation was submitted to the convention by a committee from the Colorado Forestry Association:

To the Democratic State Convention.

GENTLEMEN: We, the undersigned, a committee duly appointed by the Executive Board of the Colorado State Forestry Association for the express purpose herein named, respectfully present the enclosed resolution, asking that you insert it in your party platform:

For the reason that when we consider the importance of our forests in their bearing upon the leading industries of the state; when we see the vast destruction of timber on almost every mountain side; when we are told by those who best know that at least four to five-sixths of our virgin forests have been destroyed chiefly by careless fires, and when we further realize that the state has made no provision for forest management, that there is no executive officer to see that our forest laws are enforced, we are impressed that it is imperative that something be done, and done at once, to establish some well-defined and rational forest policy.

For this purpose, therefore, we appear in this manner, feeling assured that your honorable body will be interested and ready to coöperate in this movement, which we believe to be for the present and future welfare of our beloved commonwealth.

Respectfully submitted.

PLATT ROGERS,
E. B. MORGAN,
HELEN L. GRENFELL,
A. W. RUCKER,
JOHN S. TITCOMB,

Committee.



TWO VIEWS SHOWING COMPLETE DESTRUCTION OF WESTERN FORESTS BY REPEATED
FOREST FIRES.

The plank requested is as follows :

Whereas the forests of the state are of the greatest importance for the production of timber and the conservation of moisture in the economy of our water supply ; and

Whereas they are being destroyed by fire and wasteful methods of lumbering, to the serious detriment of our leading industries ; therefore,

Be it resolved, That this convention earnestly recommends such legislation under the state constitution as shall provide for a Department of Forestry and the enactment of such laws as may be necessary to enable it to make our forests more permanent and useful.

This plank was adopted by the Republican State Convention as a part of its platform.



Good Opening in Philippines. Capt. Geo. P. Ahern, chief of the Philippine Forestry Bureau at Manila, is at present in the United States. His address is care of the Philippine Exposition Board, World's Fair, St. Louis, where he will be glad to hear from foresters who would like to enter the Philippine service. At present there is an especially good opportunity for young men to secure positions in the Philippine Forestry Bureau. Particulars about the work and the salaries paid are included in an advertisement elsewhere in this issue.



Irrigation in Italy. Irrigation has been practiced in this country little more than 50 years, while in Italy it has been practiced for more than 500 years. It is, therefore, natural that Italian experience should be able to show much of value to American irrigators. For the purpose of determining what could be learned in that country which could be applied to our own problems, Dr. Elwood Mead, Chief of Irrigation and Drainage Investigations of the Office of Experiment Stations, U. S. Department of Agriculture, spent the summer of 1903 in the valley of the Po. A partial report of Dr. Mead's observations has just been issued by the Department of Agriculture as

Bulletin 144 of the Office of Experiment Stations. No attempt was made to make this an exhaustive monograph upon irrigation in northern Italy, but the study was made solely from the standpoint of obtaining suggestions for American irrigation practice.

Contrary to a very common opinion, the valley of the Po is not an arid region. The annual rainfall at Milan, the chief city of Lombardy, is more than 40 inches—greater than that of Cincinnati, Ohio, or Omaha, Neb., both of which are situated in regions where irrigation is seldom considered in connection with agriculture. The climate of Lombardy is not different from that of the Mississippi Valley, and the crops raised, with few exceptions, are the same. Notwithstanding this large rainfall and the fact that crops can be successfully raised without irrigation, the plains of Lombardy are a network of canals and drains. To secure the construction of one of these canals, the city of Milan gave a bonus of \$400,000. This canal cost \$6,000,000, or \$37.50 for each acre of land that can be served by it. It supplies water to 8,000 farmers, who pay from one to two dollars per acre per year for water. Some of this land supports as many as 800 people per square mile, and has increased in value since the building of the canal from 60 to 100 per cent, land which formerly sold for \$100 being worth from \$160 to \$200 per acre.

Under the Vettabbia Canal, which uses the sewage from Milan, meadows yield an annual crop worth \$300 per acre. Some of the fields have been used for meadows continuously for 700 years. Annual rentals for these lands are more than \$25 per acre. Sewage has been used on these fields for centuries without injury to the lands or to the healthfulness of the community. This great rise in land values and increase in productivity of lands, due to irrigation, in a region with a rainfall equal to that of the southern half of the Mississippi Valley and a climate no more favorable to crop production, leads to the conclusion that in irrigation this section has a means of at least doubling the present yield from its lands.

In Piedmont, which has an annual rainfall of more than 30 inches, or about the same as eastern Nebraska and Kansas, the Italian government has built nearly a thousand miles of canals and expended about \$20,000,000 for irrigation works. The annual income from the government canals in this province is nearly \$600,000. Pumping plants have been established to raise the water to lands above the government canals. One of these was put in at an expense of \$47 per acre for the lands irrigated, in addition to which the farmers are required to pay the annual maintenance expense and \$82 per year for a cubic foot of water per second. Irrigated land supplied by this pumping plant is worth three times as much as unirrigated land adjoining. Under another pumping plant the annual expense to the farmers is \$5.80 per acre, in addition to \$10 per year for a sinking fund, making an annual charge upon the farmers of nearly \$16 per acre; and this also in a region where crops can be raised successfully without irrigation.

The Italian government disposes of water directly to farmers at retail in some sections, and in others sells it to cooperative associations of farmers. One such association has 14,000 members, operates 9,600 miles of ditches, has 266 miles of telephone and telegraph lines, supplies water to 141,000 acres, and does an annual business of \$600,000. Eighty water masters are employed by the association to distribute the water to its members. The farmers in this association pay from \$1.60 to \$9 per acre per year for water, according to the distances of their land from the main canal and the crops raised.

In addition to giving information as to the organization of the industry in Italy, the bulletin describes the principal canals of Lombardy and Piedmont, and gives details as to the structures for diverting water and carrying it over or under the streams or canals crossed. Drawings and photographs of a large number of structures are given.

Italian engineers have given more attention to the measurement of water than any other body of men in the world. The bulletin describes the methods of

measurement of water in use along the Po, and gives a general discussion of the subject of water measurement.

The most striking points brought out by the report are the large expenditures for irrigation in a region where crops can be raised without it, the enduring and expensive nature of the structures, and the efficient coöperation of irrigators in using water and in canal management. Along each of these lines Italian experience is full of suggestion for those interested in American irrigation.



Perpetual Injunction. In the United States circuit court at Los Angeles recently Judge

Wellborn signed decrees in the celebrated Fresno "sheep cases," granting a perpetual injunction against the defendants, which restrains them from driving their sheep across the Sierra Forest Reservation without permission from the Government officers.

Marvin Simpson, George Shipp, Frank Estelle, Anderson Blasingame, and John Shipp, all of Fresno, are the defendants in these cases, and, as they are among the largest sheep-raisers in the state, the cases have attracted a great deal of attention.



Largest Tree. The largest tree in the world is reported again, this time from the vicinity of Mt. Etna. It is a chestnut, said to be 212 feet in circumference 60 feet from the ground. More remarkable than its huge girth is the point on the trunk at which this measurement is said to have been made.



Oregon Reclamation Work. Under the direction of Mr. J. T. Whistler, engineer in charge of the

Malheur (Oregon) reclamation project, field parties were engaged during August in the development of topography of irrigable lands under the system, followed by location of preliminary canal lines. Drill work was begun the first of the month on four possible dam sites at the upper end

of the canyon below Little Valley. Two or more holes were put down at each of these sites, showing apparently good foundation for dam at from five to fifteen feet below the surface. At the direction of the Board of Consulting Engineers, a more complete investigation will be made of the most favorable of these four sites.

Discharge measurements and other data relating to the use of water under present ditches in the Malheur project are being continued.

During the month successive mass meetings were held by the citizens in order to organize an association to legally take up the proposal of the Reclamation Service. A mass meeting on the 9th ratified the proposed articles of incorporation for a water users' association along the lines of the Salt River Valley Water Users' Association, and a committee of seventeen representative men of the valley was authorized to solicit subscriptions under these articles. The state law requires a majority of capital stock of the corporation to be subscribed before the election of officers can take place, and also thirty days' notice of said election. A majority of the stock having been subscribed prior to the 29th of August, the election was advertised to take place on the 27th of September.

Field parties have been busy carrying on investigations in other parts of the state, looking to the storage and diversion of waters for the irrigation of lands in various localities. These investigations, however, have not been carried to a point where it is possible to determine the feasibility of the several schemes under contemplation.



Progress in Arizona.

Mr. Louis C. Hill, supervising engineer in charge of the Salt River project, Arizona, reports considerable damage by high water during August on the headworks and sluicing tunnels. The water in the river rose to a point higher than has been reached since 1891, and filled the headworks tunnel about half full of mud. It stood some three feet over the top of the sluicing tunnel and made the canyon road im-

passable. A rough estimate showed 20,000 second-feet passing the dam site.

Six tunnels are now driven, and it is expected that four others will be finished during the month of September. Operations on the Phoenix-Roosevelt road have progressed satisfactorily, and most of the heaviest work of the road is completed.

The investigations on the two reservoir sites on the upper Gila are nearly completed, and a gaging station is to be established here and measurements made of the quantity of water in the river, as the whole question as to the value of this reservoir hinges upon the water supply.

August saw the practical completion of the chemical investigations on the Salt River and the wells around Phoenix and the country west and southwest of that city. A large number of analyses were made and maps and reports prepared which give very complete information as to the distribution of salt in the underground waters of Salt River Valley.



La Plata Project.

Upon the recommendation of the Director of the U. S. Geological Survey 15 townships of land lying in and tributary to the La Plata and Animas river valleys in New Mexico, and aggregating approximately 308,736 acres and $4\frac{1}{2}$ townships, embracing approximately 80,640 acres lying in Colorado along the Animas River, have been segregated under the first form of withdrawal, pending investigations by the engineers of the Reclamation Service in connection with their reclamation by irrigation.

This project, known as the La Plata project, is located on a tributary of the La Plata River in San Juan county, in northwestern New Mexico. The main source of water supply is from Animas River and its tributaries, and possibly from Los Pinos River in Colorado. The supply will be diverted from Animas River either near the Colorado-New Mexico line and conveyed to lands lying in and along the La Plata Valley by means of canals aggregating approxi-

mately 100 miles in length, or by means of comparatively short tunnels through the high divide between the Animas and La Plata rivers and a much shorter line of canals connecting the ends of the tunnels with the points of diversion and delivery.

If the development of this project, which contemplates the reclamation of approximately 50,000 acres of land, is found feasible, it will be necessary to supplement the minimum flow in Animas River during a portion of the irrigating season by storage, both at the head of La Plata Valley and on Animas River, there being an abundance of water for this purpose during high-water period.

Preliminary investigations have been made and reconnaissance surveys for the purpose of locating storage facilities. At the present time field parties are being equipped for a survey of the diversion canal lines and possible reservoir sites and lands affected by the project. Probably two or three months will be required for this work.



Favorable Outlook in California.

The progress made by the engineers of the Reclamation Service in California during August is most gratifying. Stream measurements, duty of water measurements, and evaporation records were maintained in various places in the state, and the several projects have received general and individual attention.

Yuma Project.—Work on this project consisted principally in making plans and estimates on canal lines, quantities for canals, and estimates on a pumping plant for the Yuma mesa, and in the preparation of a map of farm units for this project along the lines of practice established elsewhere. As early as August 27, 75 per cent of the area of private lands below the canals and inside the levees had signed the contracts necessary prior to advertising for bids for construction. When all the lands subject to the Reclamation Act—for instance, the Indian reservation—are included, this percentage is materially higher; in fact, nearly sufficient.

Klamath Project.—Surveys are being made of the Horse Fly and Clear Lake reservoir sites, and a topographic survey of the Klamath River near Keno where it is possible to lower the channel and drain the lower Klamath region. A determination of the area of irrigable lands and surveys and other preliminary work will be rapidly pushed in order to determine the feasibility of this project at as early a date as possible.

Owens Valley Project.—During the month of August, Mr. J. C. Clausen of the Reclamation Service, who has in charge of the Owens Valley project, completed the examination of all the small mountain lakes along the eastern side of the Sierra Nevada's tributary to Owens Valley. The most promising of these have been surveyed sufficiently to compute the capacities of reservoir sites. A map of the irrigated lands in the valley is being revised for the purpose of making a distinction between the land with sufficient water supply and those with insufficient supply, and a study is being made in the valley in a preliminary way of a large percentage of land that through irrigation has become swamp or alkali.

Another inspection was made of the Long Valley dam site. The rock at this site is of volcanic origin, weighing about 100 pounds to the cubic foot, and appears to be in one well-consolidated mass and not in independent layers. As the use of this reservoir site is entirely dependent upon bed-rock conditions, a thorough exploration with the diamond-drill machine will be made. If this reservoir is found feasible, a detailed survey will be made in the valley.

It is believed that this project would supply water to from 75,000 to 100,000 acres, 40,000 acres of that amount now being irrigated in the valley. The engineers believe that the smaller tributaries of Owens River will supply sufficient water during spring and early summer for all the systems, and by holding back the entire flood flow of the Owens River for late summer use it will be possible to greatly extend and benefit the irrigation system in the valley and supply water for the irrigation of additional lands.



JOHN ELLIS FIELD,

IN CHARGE OF IMPORTANT RECLAMATION PROJECTS IN THE WEST.

AN engineer in whom technical skill and administrative ability are combined to a high degree is Mr. John E. Field, of the U. S. Reclamation Service. He was born in Colorado on May 13, 1867, and graduated from Yale with the degree of Ph. B. in 1888. From 1888 to 1893 he was engaged in the practice of mining, civil and hydraulic engineering in the mining camps of Colorado. From 1888 to 1889 he was assayer and chemist for the Aspen Public Ore Sampling Works in Denver, and served in a similar capacity from 1890 to 1891 for the Taylor and Brenton Sampling Works. He then engaged in civil and hydraulic engineering practice until 1893, when he was appointed chief examiner of mineral surveys for the United States surveyor-general of Colorado, serving in that capacity until 1899, when he became assistant engineer on the board of public works at Denver. In 1901 Mr. Field was made deputy state hydraulic engineer of Colorado, and in 1903 was appointed an engineer in the Reclamation Service. He is the author of various bulletins published by the United States Department of Agriculture, and at present is directing the work in connection with several important reclamation projects in Wyoming.

THE UNDERGROUND WATERS OF SOUTHERN CALIFORNIA.*

BY

WALTER C. MENDENHALL,

U. S. GEOLOGICAL SURVEY.

IT often happens that in inaugurating work along new lines only a few far-sighted men are able to discern the future bearing of that work, so that those engaged in it are constantly met with skepticism as to its usefulness. This is particularly true in America, where the direct practical question—What is it for?—must be met and a satisfactory answer returned before support will be given to any line of activity. This is no less true of governmental than of private work. It is indeed much more emphatically true of work of a public nature, because as each citizen contributes to the support of that work he feels a personal interest in it, and, true to the instinct of his race, demands that it have a direct and useful bearing upon every-day affairs. This is on the whole a most healthful spirit. Its effect is to subject each public project to a searching examination, in which those who plan it must be able to justify it on the broad basis of usefulness.

Our government bureaus, which have been created and have expanded in an atmosphere of this kind, are eminently practical. Their constant endeavor is to secure results of direct benefit to the body politic and of immediate application in daily life. To the more abstruse results, whose bearing upon practical problems is less manifest or more slowly realized, much less attention is devoted. As a consequence there is little of the aloofness in the public service here, which marks it in some of the older countries of the continent.

The Geological Survey is one of a number of such government bureaus which endeavors always to guide its work into useful channels and to give it a direct practical bearing. When it

came into existence, 25 years ago, the value of such work as it was created to do had been made manifest through the geographic and geologic achievements of its predecessors, the various trans-continental surveys. Its maps, upon which the physical features of the various sections are faithfully shown, and its reports upon the mineral deposits of the West, and later of the East—reports in which the deductions of its special students were made available for the use of the practical mining man—filled a distinct want and led to the support of the Bureau by Congress and to the gradual extension of its functions.

As the most attractive parts of the West were settled and interest was aroused in the possibility of reclaiming its arid lands, the Survey, responding to this interest, undertook a series of observations to determine the amount of water available for the purpose. That branch of the organization which undertook this work is known as the Division of Hydrography. When, two years ago, the plans for rescuing the arid lands from their desert condition crystallized in the famous Reclamation Act, the Secretary of the Interior, to whom was entrusted the task of carrying its provisions into effect, turned to the Bureau, which for a decade had been collecting the data, without which no single project could safely be undertaken, and the Director of the Geological Survey was instructed to take up the actual work of constructing great irrigating systems, to be sold at cost to the communities benefited.

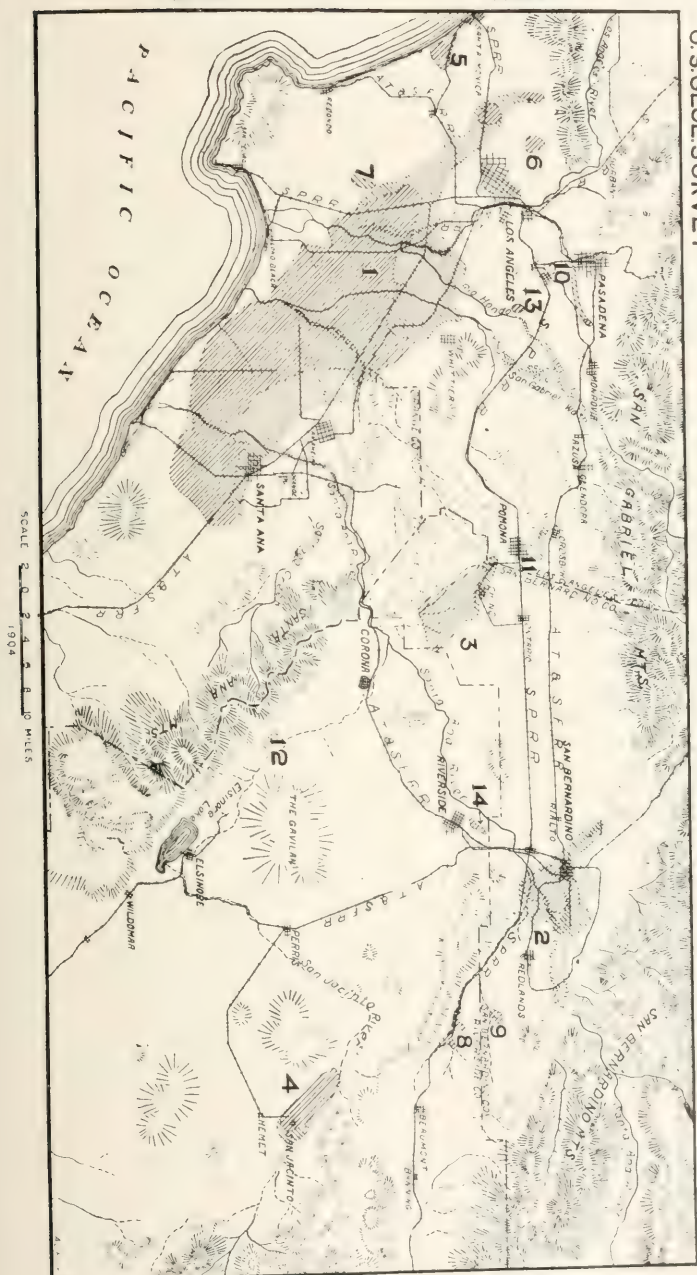
Out of the experience of the Hydrographic Branch and the Reclamation Service there arose the need for a special study of underground waters—their oc-

* Published by permission of the Director, U. S. Geological Survey.

MAP
of the
ARTESIAN BASINS
in the
VALLEY OF SOUTHERN CALIFORNIA
U.S.GEOL.SURVEY
DIV. OF HYDROLOGY

APPROXIMATE
ORIGINAL
ARTESIAN AREAS
375 SQ. MILES

PRESENT
ARTESIAN AREAS
250 SQ. MILES



- LEGEND
- 1 COASTAL BASIN
 - 2 SAN BERNARDINO BASIN
 - 3 CORONA BASIN
 - 4 SAN ANTONIO BASIN
 - 5 SAN ANTONIO BASIN
 - 6 COLORADO BASIN
 - 7 SAN ANTONIO BASIN
 - 8 SAN THOMAS BASIN
 - 9 COLORADO BASIN
 - 10 COLORADO BASIN
 - 11 COLORADO BASIN
 - 12 COLORADO BASIN
 - 13 COLORADO BASIN
 - 14 COLORADO BASIN

currence, volume, and the laws governing their replenishment—since in parts of the arid and semi-arid West these are important sources of supply for domestic purposes and for irrigation. Such studies had been carried out especially along the eastern slope of the Rocky Mountains and the adjacent parts of the Great Plains by the Hydrographic Branch previous to the organization of the Reclamation Service; but soon after its organization this work was segregated into a separate division, known as the Division of Hydrology, with eastern and western sections, under separate chiefs.

For the actual field work in this division, geologists have usually been detailed from the Division of Geology, with which, and the Reclamation Service, the new division is closely affiliated. Its problems are largely geologic problems, since the distribution, the circulation, and the quantities of underground waters depend upon geologic facts. Its relations with the hydrographic work are most intimate, as the questions of replenishment of underground reservoirs and drafts upon them are in many cases questions whose answers depend upon water and rainfall measurements.

One of the first important fields in which work was undertaken by the new division is that of the valley of southern California, long well known throughout the United States as the center of orange culture, and as possessed of a mild and equable climate which is rapidly making it to America what the south of France is to Europe, a region of beautiful homes and a center of wealth, culture, and pleasant leisure. This work is now well under way, its results are rapidly being made available, and they promise to be of great interest and value to the people of this part of the Southwest.

The greatest population and the highest cultural interests of southern California are distributed through a wide, beautifully diversified valley that extends 80 miles inland from the Pacific at Port Los Angeles, and is effectually separated from the Mohave and Colorado deserts by the San Gabriel and San Bernardino mountain ranges on the north and east.

These high groups protect the lands on their Pacific slope from the climatic extremes of the deserts, and at the same time wring from the ocean winds the moisture with which they are laden and which in the form of perennial streams makes possible the high state of cultivation which has given some of the adjacent agricultural lands values of \$2,000 or even \$3,000 per acre.

Previous to man's occupancy of this region the streams, issuing from the mountain canyons as perennial flows, sank at once, except in cases of rare floods, into the alluvial gravels and sands, which have been piled up about the canyon mouths as evidences of the deliberate, but unceasing, erosional processes of the past ages. Percolating slowly seaward through this alluvium, the waters encountering subterranean obstructions are forced to the surface at certain points in their courses, only to sink again once the obstruction is passed. Thus, some of the rivers disappear and reappear several times in their passage to the sea.

When white men first entered the region they settled about these areas of rising waters, points where the streams were forced out as springs by some impenetrable body of rock or clay. In these damp lands irrigation was unnecessary, and if it became desirable to extend the cultivated area slightly beyond them a short ditch sufficed to carry the water to the desired spot, so that the few irrigation projects were of the simplest sort. Average rainfall in the valley is from 10 to 20 inches, the greater amount near the mountains, the lesser at some distance from them, and practically all of it falls in the winter months, from October to May. Irrigation, therefore, except on these moist "*ciénega*" lands, is necessary to mature the majority of crops.

With the slow settlement of the region by Americans after the Mexican cession and the gold discoveries in California, the desire to extend the cultivated areas led to the building of ditches, either from the *ciénegas*, the areas of springs, or from the streams which flow out of the mountains. These systems were rapidly extended

and improved, until practically all of the flowing mountain and valley waters were appropriated and made useful for irrigation or as a source of domestic supply for the growing villages and cities.

The next step taken to increase the water resources was usually in the direction of attempts to intercept the sub-surface seepage by systems of shafts and tunnels, or to increase the flow of the large *cienegas* by similar means.

In two or three instances storage reservoirs have been built, whose object is to save those excess waters which pass to the sea during the exceptional floods of winter, and thus are entirely lost. Notable among reservoirs of this type is the Bear Valley dam, in the San Bernardino Mountains, at an elevation of 6,500 feet. Its waters furnish the main supply for the flourishing colony tributary to Redlands, in the eastern end of the valley. Similarly the Hemet dam, in the San Jacinto Mountains, stores the winter rains for use during the irrigating season on the plains in the vicinity of Hemet. Other unique features in hydraulic engineering are the submerged dams in the Pacoima Wash, San Fernando Valley, and in the canyon of Santiago Creek, Orange county. These are concrete structures, built across the underground channels of the streams to intercept the percolating waters as they find their way seaward through the porous sands and gravels of the stream bed. The waters thus intercepted are forced to the surface by the dam or are pumped from its upper side and distributed in the usual manner by main pipes and laterals to the lands which it is desired to irrigate.

In no part of the United States have the methods of irrigation engineering been so highly developed as here. A few of the less important old canals are cut in earth and are unlined, with irregular grades and leaky beds; but all the more important systems have been built by engineers after careful surveys, are cement lined or of concrete construction, many of them covered and supplied with most effective headworks and distributing systems. Recent practice has been in the direction of using con-

crete pipe for the main lines, thus preventing all loss of water from leakage or evaporation in transit from its source to the point of distribution.

In late years, because of the complete appropriation of all the surface streams and a natural desire to extend the areas so profitably cultivated, water-users have turned their attention more, and more to the subterranean supplies, and in some cases flourishing communities have been built up which depend entirely upon these for their irrigation water.

As a result of the geologic and climatic processes which have given the picturesque combinations of mountain and plain that make up the landscape and much of the charm of southern California, a number of deep and capacious underground reservoirs have formed, which through the past centuries have been charged with the waters flowing from the mountains, and are now yielding these waters that the tributary lands may be made fruitful.

The origin of these basins in its broad outlines is simple, although the details may often be most complex. In general the high mountains are areas which have been uplifted during the crustal movements that have been so marked a feature of the later geologic history of the region, and the valleys are areas which have been depressed during the same processes. These furnish unusual types of valleys, whose width and extent bear no particular relation to the streams that flow through them. The normal stream valley, unlike these California valleys, has been cut by the stream which occupies it, is broad and flat where the stream is large, constricted where the stream is small, and is in every way adjusted to the stream that has produced it. But these basins, which together constitute the region known as the Valley of Southern California, owe their origin to earth movements instead of stream action, and the principal function of the streams has been not to deepen and broaden them, but to fill them up, smoothing them and partially burying the inequalities which resulted from the crinkling and buckling of the earth's crust, to which they are due.

Thus, as the San Bernardino Mountains were uplifted and the valley to the south of them sank, the streams rising in the high range carried quantities of detritus, boulders, gravel, sand, and clay into the lowland, and there deposited it. The rock floor of this valley is below sea-level, while its present surface is 1,000 to 1,500 feet above. This surface has been thus raised by the accumulation of material brought in by the mountain streams—loose, porous detritus, saturated by the mountain waters, and so constituting a great underground reservoir.

Similarly, while the ridge, which in various parts is known as the San José Hills, the Puente Hills, and the Santa Ana Mountains, has been uplifted, an area north of it has been depressed until its bedrock bottom, in places at least, lies below sea-level. This valley has also been filled by the loose material brought in by the San Antonio, the Santa Ana, and other streams, until the valley level is now several hundred feet above the sea. This great mass of loose débris, like that in the San Bernardino Valley, has been saturated by water supplied by the rainfall of the past, and serves as a storage reservoir.

Between the Santa Ana Mountains and their extension on the one side and the Pacific Ocean on the other lies the coastal plain of southern California, 10 or 20 miles wide and with a northwest-southeast dimension of 40 or 50 miles. This again is a lowland, built up largely of sands and gravels contributed by the various rivers which flow across it. The waves and currents of the ocean have probably contributed to the supply and have certainly aided in its distribution. These alluvial and marine deposits are saturated, as are the exclusively alluvial deposits farther inland, and constitute a very large underground reservoir of fresh water.

In portions of all of these basins, whose origin has been thus roughly sketched, the alteration of coarse and fine deposits, pervious and impervious beds, representing more or less rapid deposition, has been such that some of the waters, percolating along the easiest channel, have passed beneath sloping,

overlying beds of clay, and, accumulating there under pressure, flow when the impervious bed above them is pierced. Practically all of the artesian waters in the valley—and they are of great importance and wide distribution—occur under these conditions. The synclinal rock basins, which have come to be recognized as typical of regions in which artesian waters are found, are of little importance here.

These special artesian conditions, which are characteristic of the alluvial fans and the Coastal Plain deposits, possess certain definite attributes, some of which are advantageous and others of which are disadvantageous, from the point of view of the water-user.

In the first place, the gravels are loose, free, and coarse, so that they have a high transmission capacity, the water passing through them readily. Under these conditions there is no possibility of failure from the cause effective in the Denver basin, for example, namely, an inability on the part of the water-bearing rock to transmit the waters as fast as they are withdrawn by the wells. But this very openness creates another danger, that of exhaustion of the stored waters, which flow so freely to the point of exit that shallow wells of 10-inch bore have yielded as much as 400 miner's inches.

Again, in the majority of the basins the first water-bearing stratum is found at a very moderate depth, often less than 100 feet. Small wells may be sunk to such depths at very slight cost—so slight, indeed, that ranchers have found it more economical to sink a number on a small tract than to distribute the water from a central well. This condition has encouraged larger drafts upon the supply than would be made in an artesian basin, where the waters were farther from the surface and less readily accessible.

In its preliminary work upon the underground waters of southern California, the U. S. Geological Survey has mapped the principal artesian areas in their present and their original outlines. The results which are shown in the accompanying illustration are of considerable interest, and reveal the rather astonishing fact that at one time this semi-arid

region contained 375 square miles of artesian water-bearing lands, distributed through a number of basins—that is, artesian conditions existed under approximately one-sixth of the valley lands which could be made tillable and productive by the application of water. In addition, there were large areas bordering the artesian belts in which the ground water lay near enough to the surface to be accessible by pumps of various sorts, and in some districts these have been extensively utilized for irrigation.

The principal of the artesian basins are those of the Coastal Plain, Chino, San Bernardino, and San Jacinto, with approximate original areas of 295, 24, 30, and 14 square miles respectively. The water supplied by each of these has been extensively drawn upon during the past decade, the heaviest drafts being from the Coastal Plain and the San Bernardino sources. In the former case the waters supply the towns of the coast, and are used for the diversified crops of citrus and deciduous fruits, alfalfa, walnuts, grapes, and celery, which are raised there. The underground San Bernardino waters supply the towns of San Bernardino, Colton, and Riverside, are used for local irrigation within the San Bernardino valley, and are the principal source from which the splendid Riverside colony draws its supply for irrigation.

These subterranean sources have been most extensively developed within the past ten years. Practically all the acreage added to the irrigated districts within that time have been through the addition of artesian or pumped waters to the surface supply. These same years have on the whole been years of low rainfall in southern California, just as the previous decade, during which these developments began, was one of high rainfall. Under the combination of heavy withdrawals of ground waters and a shortage of the rain, which is depended upon to recharge the subterranean reservoirs, these have declined notably. As a result, the original area of 375 square miles of artesian lands has shrunk 33 per cent, to 250 square miles. Pressures and yield in wells

which are still flowing have notably decreased, the ground-water level outside the artesian belts has declined, and a feeling of uneasiness pervades some of the irrigating communities as to the permanence of their supply. On the whole, the subterranean reservoirs must be regarded as resisting the drafts upon them remarkably well. The summer waters which once flowed from the mountain canyons out upon the valley washes, where they promptly sank and added their volume to that of the stored underground supplies, have been appropriated and are used for irrigation. The proportion of them that escapes direct evaporation from the soil and indirect evaporation by transpiration through the plants varies with soils and irrigation practice, but must on the whole be small. This small residue alone is now added to the underground reserves, where formerly nearly all of the summer flow contributed. The storm waters of the winter season have always been the chief factor in filling the subsurface gravels, and these are still available in greater part, although a few storage reservoirs, like that of Hemet and Bear Valley, intercept flood waters, a part of which, were they not thus intercepted, would be absorbed on their way to the sea by the gravels. These are factors which have diminished the annual accessions to the underground supplies, although, if the communities as a whole are considered, storage of flood waters must be considered most economical engineering, since it undoubtedly diminishes the total loss through excessive floods. It is only from the special point of view of the companies or communities immediately dependent upon the saturated bodies of gravel for a supply that this storage can be considered disadvantageous. On the other hand, with the partial drainage of the gravels their absorptive capacity is increased, and in consequence a larger proportion of the flood waters must be taken up as they flow across the valleys than before. Actually, therefore, by drawing heavily upon the underground reservoirs, the amount of water which is lost in floods is decreased, and the total

amount available for irrigation is increased by an unknown but certainly not great amount. The algebraic sum of all these factors, of which the principal are the rainfall and the direct drafts upon supply, has without question been a loss for the ten years past in most parts of southern California.

In a few cases the lowering of the plane of saturation has been serious, a drop of 60 or 70 feet being recorded extremes for the period from 1900 to 1904, during which the deficiency of rainfall has been roughly 20 per cent. In other sections, where the body of saturated gravels drawn upon has been larger, or where the drafts have not been so great, the diminution of supply has been less marked, but the phenomena of a lowering ground-water level, shrinking artesian areas, and a diminishing artesian flow are general. This fact is not in itself enough to justify alarm. It is recognized that the proper function of these stored supplies is to tide the communities through the dry periods. They will be most heavily drawn upon when the rainfall is lightest, and will then inevitably shrink, just as a nation's gold reserve will shrink in the stress of war.

As a compensating influence, they should be subject to comparatively light drafts when the rainfall is heavy, as less water is required for irrigation then, and the surface streams, flowing near their maximum, are supplying the greater part of this minimum required amount. It is during such periods that the ground-water level should be restored, and the artesian areas expand to their original outlines. As the past decade has, on the whole, been one during which the precipitation is well below the general average, a decline is not a matter of surprise. The danger to irrigating communities which depend upon subterranean waters whose amount can not be directly measured, and is therefore peculiarly liable to overestimation by our optimistic American communities, is that they will not restrict themselves in their use of these reserve supplies during dry years to an amount which will be restored during wet seasons. It is easy to sink more wells,

pump more water, and reclaim more land. It is difficult and requires patience and self-restraint to check development until it is determined how far this process can be carried without permanent depletion of the reserves and resultant injury to the communities. In some districts in the valley of southern California the responsible far-sighted citizens are endeavoring to create a conservative sentiment, opposed to the further reclamation of virgin lands until the effect of a series of years of abundant rainfall upon the falling water plane can be determined. Evidence already exists to show that in particular localities, at least, average rainfall will check the rate of the decline, but will not stop it. In the face of this fact, economy in the use of water and conservatism in its development are imperative.

The abundance of water in the moist lands has generated in their owners habits of wastefulness and prodigality which are out of place in communities in semi-arid regions, whose future depends entirely upon the stability of the water supply. California is prodigal in many things. Habits of economy do not come easily to her. She has always received and dispensed with equal lavishness, and a part of her great charm is due to this abounding generosity. Her citizens must learn, however, that any natural resource less inexhaustible than sunshine and pure air may be depleted if spent too freely; that much more may be accomplished with it if its value is appreciated and due care is exercised in its use. She must come to understand unequivocally that the citizen who uses unnecessarily or otherwise wastes her water supplies, which are as essential as her balmy air and bright days to the extension of that hospitality in which she takes such pride, is a public enemy who will sacrifice the interests of his neighbors, his community, and his state to his own thoughtlessness, his own avarice, or his own indolence.

Care is just as essential where the life-giving fluid seems most abundant as in those other localities where its scarcity makes an admonition to economy trite. Indeed, the greatest shrinkages in artesian basins are due particularly to the

drilling and the careless handling of too many wells in the lowest, best watered parts of the artesian area, where the depletion is felt last and least seriously.

Drafts here tap the basin at its lowest and most vulnerable point, and draw the water away from the higher, less favorably situated lands.

THE BASKET WILLOW.

THE BUREAU OF FORESTRY SUGGESTS A NEW METHOD OF GROWING WILLOWS THAT WILL YIELD A BETTER GRADE AND INCREASE PRODUCTION PER ACRE.

THE culture and manufacture of basket willow have not attained in the United States the degree of perfection and profit that mark the industry in Europe. This is for several reasons, the most important being, the relative compensation of labor and the failure of the American grower to adopt the most improved methods. The growing, harvesting, care, and manufacture of willow require manual labor wholly unassisted by machinery. The cheap labor of Europe has grown willow, and woven it into baskets at a profit impossible with us and our better paid labor. American ingenuity has still further complicated the issue by producing a cheap split-wood basket to take the place of the more expensive and durable

willow. Thus an industry of good possibilities is languishing.

The Bureau of Forestry has taken up the matter and given it careful study. Its expert has thoroughly investigated the methods of culture and manufacture both in this country and in England, Germany, and Holland. In addition the Bureau has established a willow plantation on the Department's experimental grounds near Washington, D. C., where the best species of basket willows were set out on different soils and spaced in accordance with different methods of planting. The results of this research will shortly be made known by the Bureau in a bulletin entitled "The Basket Willow."

The Bureau's purpose was to discover



PURPLE OR WELSH WILLOW (*Salix purpurea*) PLANTED 3 FEET BY 1 FOOT. MARYLAND. SEPTEMBER, 1902.



TYPICAL, WILLOW BOTTOM LAND. MARYLAND.



WILLOWS IN THE PIT, SPROUTED AND READY FOR PEELING.



PEELING WILLOWS IN THE SAP.



DRAFTING (SORTING) WILLOWS.

a means of reducing the cost of the raw product, peeled and unpeeled willow rods, and also of improving the quality. This has been definitely ascertained. It is entirely a matter of properly regulating the distance between the sets in planting, care in cutting the crop of rods, and in selecting better species and strains of willow. The custom has been to plant in rows 3 feet apart, spacing a foot in the rows between the sets. A far better plan is to put the rows only 20 inches apart and reduce the distance between the sets to 9 inches. When this is done and the crop is cut close to the ground the rods will be longer and less branchy, the plants longer lived, and the yield per acre much greater. The initial cost is slightly higher than under existing methods, but this is more than offset by the increased returns. At present an average production of six tons of green rods per acre is exceptional; by the method now advocated by the Bureau eight or more tons per acre of better rods can be produced. When to improved methods of culture, the advantages from a choice of better European varieties of willows for planting are added, the result will be a marked reduction in the price of the raw material and a distinct betterment of the condition of both the producer and manufacturer.

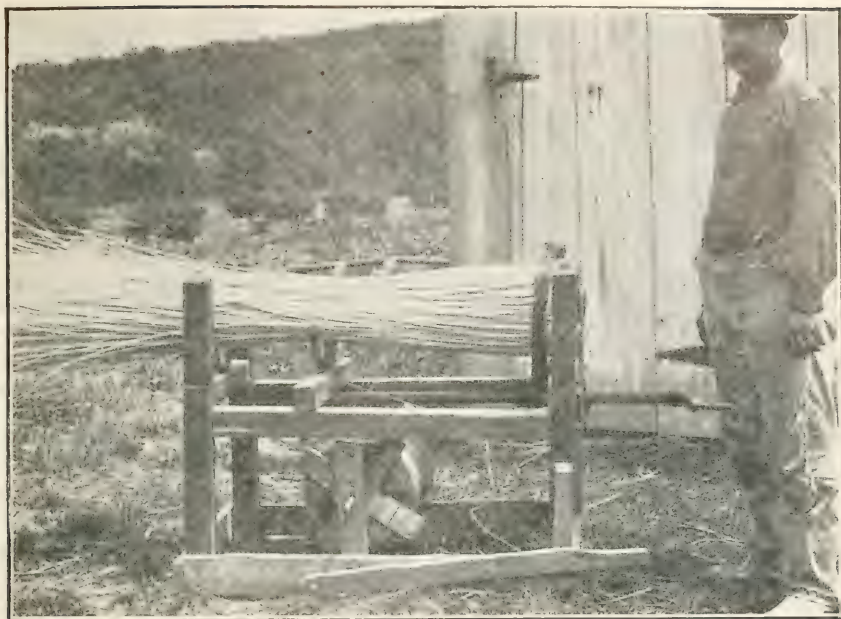
The growing of basket willows was introduced into the United States some sixty years ago by German basket-makers, who settled in western New York and Pennsylvania. They first attempted to use wild willows, but soon abandoned these as impracticable and imported the purple or Welsh willow. They grew the rods, and the manufacture into baskets was made profitable by whole families engaging in the weaving. Their product has always been a cheap variety of basket, since they use steam in peeling the rods, which gives them an undesirable dark color. When the industry was extended farther west and down to the Baltimore district, Maryland, hand-peeled rods were used and a much higher grade basket manufactured. But this country, in the extensive use of willow-ware, has never approached Europe, where are found

not only heavy farm baskets and receptacles made of unpeeled willow, but market, clothes, and fruit baskets of peeled willow, furniture, hampers, and trunks, and most artistically wrought split willow-ware designed for countless other uses. Could all these be as cheaply manufactured here as there, their use by us would doubtless be as extensive as that across the sea, for willow-ware is not only prettier than its substitutes, but, what is still more important, lighter and more durable.

Another use for willow in this country is found in the growing demand for willow furniture, which has become fashionable in the North, while in the warm climate of the South it is rapidly taking the place of upholstered furniture. Good wages can be paid in the manufacture of this kind of furniture. It is a profitable industry and steadily growing in importance, while willow-basket making has barely held its own in the last decade. The demand for furniture material has been met to this time chiefly by importing French rods. But this can be changed if our own willow-growers will adopt more scientific methods of culture and market their rods only after they are well seasoned—not soon after cutting, as is now customary.

In the bulletin by William F. Hubbard, which the Bureau will issue in a few days, every aspect of willow culture and manufacture is exhaustively treated. The character of the ground to be used, preliminary cultivation, planting, weeding and cultivation, cutting, sorting, peeling, and packing, all are discussed thoroughly, and advice as to each branch of the work is clearly given. The virtues and defects of the different species of willows suited to basket manufacture are described. Inundation in the spring after harvest and before the new crop season opens is a new aid in protecting the holts from insects and in fertilizing the sets especially advised by the Bureau.

A valuable part of the bulletin is a chapter on insects injurious to basket willows, prepared by the Bureau of Entomology. This not only describes the insect enemies of the willow, but



MACHINE FOR BUNDLING WILLOWS FOR MARKET.



DIFFERENT KINDS OF PEELED AND UNPEELED WILLOW SHIPPING BASKETS ON THE DOCK AT ROTTERDAM, HOLLAND.

also gives methods for their control. The bulletin should prove invaluable to all present producers and manufact-

urers of basket willow, and of great interest to farmers who desire to add willow-growing to their other crops.

CONTROL OF THE KANSAS RIVER FLOODS

TREE PLANTING ADVISED BY THE BUREAU OF FORESTRY—LAST YEAR'S LOSS OVER \$20,000,000.

THE Kansas River floods have called new attention to the methods recently advocated by the Bureau of Forestry for controlling the course of the stream and for repairing the damage to inundated farm lands. The high-water mark this summer is 10 feet lower than that of last season, nor is the property loss comparable to that of a year ago, when the damage wrought exceeded \$20,000,000 and when over 100 lives were sacrificed. But in permanent injury to the productive capacity of the region it may well be said that the river has delivered a second blow as serious as was the first. The flood of 1903 was the greatest since 1844. Until a year ago the valley of the Kaw was as fertile as any on this continent. For centuries the strips of

woodland along the banks of the river bed impeded the rush of overflows, and the silt that built up the rich land had been precipitated. But under agriculture the trees were gradually cut down, in many cases right to the water's edge. The result was inevitable. In its natural course the river runs rather slowly and with many windings through its flat meadows. But when it overflowed the water swept straight down the valley. Unimpeded by trees, it increased its velocity, in some places cutting for itself new channels, and for almost the whole 120 miles of the valley not only deeply eroded the river banks, but played havoc with the valuable farm lands. In some places the rich soil was cut away to the barren sands or gravels; in others coarse sand was laid 6 and 8



RAILROAD TRACK ON TOP OF COAL CAR, NEAR LAWRENCE, KANSAS.



VIEW OF MISSOURI PACIFIC RAILROAD BRIDGE AT KANSAS CITY AFTER THE FLOOD.

feet deep over the fields; in still other places great holes were gouged out and lakes formed acres in extent. Of the 250,000 acres of remarkably fertile lands, worth from \$100 to \$250 an acre, which the valley contained, 10,000 acres were completely destroyed for agricultural purposes, 10,000 acres more were damaged 50 per cent of their value, and the whole area was greatly depreciated in value owing to the general sense of uncertainty as to the future. That these fears for the future were well founded the repetition of the disaster makes sufficiently plain.

But the condition of the citizens of the valley is far from hopeless if they will put into active and general operation plans for the protection and reclamation of their lands. The Bureau of Forestry has devised systems of tree planting for the river banks, the sand-covered lands, and the deeply eroded lands. The object of the first is to prevent washing of the banks, to protect the whole area from the full force of floods, and in time of overflow to check the tendency to gully and cut new channels. The last two systems of planting are for ultimately reclaiming the now destroyed lands, and making them pro-

duce in the meantime a valuable wood product while the work of reclamation is going on.

The sanded lands are now useless for crops, but will grow cottonwood, which twenty years hence will make valuable saw-logs. In the meantime the trees will be reclaiming the land for field crops. This they will do partly by the fertilizing effect of the decaying forest litter. But should the flood waters return again the timber would very likely be in a position to render much greater service. Examination of the area affected a year ago shows strikingly that where protective growths of cottonwood checked the rush of the current, the land beyond was generally covered, not with sand, but with silt, and is often, if anything, more fertile than before. With extensive planting of forest trees another flood would undoubtedly bring back at once to fertility much of the land which has now been made barren.

The lower part of the Kansas Valley was devoted chiefly to the production of potatoes. Crops of 300 to 400 bushels per acre were not uncommon before the flood. Thousands of acres of potato fields were buried two to six feet beneath coarse river sand, causing the



Courtesy Weather Bureau, U. S. Department of Agriculture.

farmers to abandon much of this land. Of 1,000 acres of once valuable sweet-potato land in one body near Wamego, Kansas, only 35 acres were cultivated last year after the flood, and this is probably all that will be fit to cultivate for many years to come.

The Bureau of Forestry is now sending to the citizens of the Kaw Valley a mimeographed circular of recommendations for guidance in forest planting on their damaged lands, in which it is said:

"Wherever the river has changed its course and straightened its channel, every possible effort should be put forth to keep it straight. Much of the damage that was caused in the great flood of 1903 is directly traceable to crooks in the stream. The soft, bare banks should be covered with willows at the earliest possible moment to prevent the stream from again becoming crooked. In addition to the protection of the caving river banks and the reclamation of the sanded

and eroded lands, the land-owners of the Kansas River Valley should immediately coöperate to secure continuous belts of timber 250 feet wide on both banks of the stream. Such protective belts will be far more serviceable than dikes of earth or masonry in mitigating the destruction that may occur from overflows. The future wealth and productiveness of the valley as a whole will be largely dependent upon the practice of forestry for protection against devastation by floods."

The conditions are peculiarly favorable for the success of tree planting in the flooded regions. The flood prepared an excellent seed bed for trees, and willow and cottonwood seedlings are growing thick on ground that was too wet to plow last year. The young cottonwoods can be taken up and set out on the sandy ridges which the flood has damaged. Thus the nursery stock will cost nothing but a little labor.

FORESTRY AT THE UNIVERSITY OF MINNESOTA.

A FULL FOUR YEARS' COURSE OFFERED AND
DEGREE CONFERRED UPON ITS COMPLETION.

WARRANTED by the success of former forest work and instruction in forestry which has been carried on at the University of Minnesota for the past 14 years, and in response to an urgent demand for it, the course in forestry in the College of Agriculture, University of Minnesota, was established in 1902, when a change in the curriculum was taking place. This is a full four years' course, parallel with the courses in other departments of the University, and leads to the degree of Bachelor of Agriculture in Forestry. It is intended to prepare men to take charge of independent forest properties, or for the government forest service, or for positions as teachers.

The location of a school of forestry at the University of Minnesota is most suitable because of the many natural advantages, easy access to a timbered

region, giving an opportunity of studying lumbering operations, the use of a well-equipped university, agricultural college, and experiment station, and the varied auxiliary forest industries centered in a large lumbering city. The Minnesota National Forest Reserve in north central Minnesota offers excellent opportunity for observing the best methods of forest management conducted by the Bureau of Forestry. The Minnesota Forest Reserve Board has recently acquired 20,000 acres, and on another tract of 1,000 acres has established a nursery and commenced the growing of seedlings for forest planting.

Opportunities are here offered to see, and in many cases to take part in, the scaling and estimating of timber, and to work in lumber camps for good pay at practical lumbering operations.

The city parks, nurseries, sawmills,

wood and furniture factories, creosoting works, and the state fish-hatchery in and about the city of Minneapolis are available for study at all times. Examples and practice in horticulture and forestry on the Experiment Station grounds can be observed throughout the whole year. Practical instruction in tree planting and in nursery work is offered in the arboretum and forest garden of the University farm. Native woodland on the farm and virgin forests nearby afford opportunity for practical demonstration in forest mensuration, silviculture, and forest botany.

A well-equipped library of the best works on forestry, the leading forestry and lumbering journals, and all the state and government publications bearing on the subject is a special feature of the department of forestry.

Reference and research work in forestry are well provided for. Forest instruments and material for the practice and study of forestry are quite complete for a new forest school.

A very desirable arrangement is that the student may take university subjects in connection with studies in the College of Agriculture. In botany, zoölogy, entomology, chemistry, physics, geology, surveying, political economy, law, and rhetoric the student has all the advantages of a large and well-equipped university.

The following from the college catalogue descriptive of the course will furnish an idea of the plan of instruction and show the emphasis laid upon practical work:

The first year in the course for those who enter other than from the Minnesota School of Agriculture deals with the elementary agricultural subjects that it is important for every manager of rural properties to be familiar with. The forester, from the very nature of his surroundings, will be largely thrown on his own resources, and should be capable of advising as to the best way of managing the farms or grazing lands that are almost always included in large forest properties. The sophomore year and one-half of each of the junior and senior years are devoted to the study of

the basal natural sciences underlying the practice of forestry, and to such academic and engineering studies as seem especially desirable here. While French is made optional with German, it is expected that German will be taken in most cases, as it is the most helpful language for those who are to study forest literature. An opportunity will be afforded to take Spanish, as it may be especially desirable to those who contemplate entering the Philippine forest service. One-half of each of the senior and junior years are devoted to the study of technical forestry, an important part of which consists of field work and excursions. Every student is required before graduation to take four weeks' work in some approved lumber camp, so as to become familiar with common lumbering operations.

Especial emphasis is laid on the value of field work and excursions. This consists of excursions to nearby forests; to lumber camps, sawmills, and wood-manufacturing and paper mills; to the Boom Company's works on the Mississippi River; to nearby nurseries, and it is expected that arrangements will be made which will afford an opportunity for students to visit some of the forests of Montana, Idaho, and Washington at a very low rate. Excursions are also frequently made in connection with the study of botany, geology, zoölogy, and nursery practice.

OUTLINE OF COURSE IN FORESTRY.

Freshman Year.—Students entering the forestry course will be required to take the freshman year the same as other students of the college of agriculture.

The Department of Agriculture.

SOPHOMORE YEAR.

First Semester.

Botany, short (4).
Chemistry (4).
German or French (4).
Agricultural Physics (2).
Rhetoric (1).
Military Drill (2).

Second Semester.

Botany, short (4).
 Surveying (4).
 German or French (4).
 Trigonometry (4).
 Agricultural Physics (2).
 Rhetoric (1).

JUNIOR YEAR.

First Semester.

Botany, Taxonomy (4).
 Forest Entomology (4).
 Forest Influence and Utility (2).
 Forest By-products (2).
 Forest Mensuration (2).
 Lumbering (2).

Second Semester.

Plant Ecology (4).
 Law, elements of contracts (1).
 Zoölogy (4).
 Wood Technology and Diseases of Wood (4).
 Forest Valuation (2).
 Silviculture (2).

SENIOR YEAR.

First Semester.

Geology, I (4).
 Silviculture (4).
 Elements of Economics (4).
 Vegetable Pathology (4).

Second Semester.

Geology, III and IV (4).
 Forest Economics (4).
 European Forestry (1).
 Forest Administration (2).
 Forest Protection (2).
 Fish Culture, Game Protection (lecture) (1).
 Thesis, seminary in reading forest literature (2).

Four practicums are required in the course in forestry, viz: in forest exploitation, forest working plans, forest mensuration, nursery practice. A thesis must be presented in each of the four subjects, giving the results of personal observation.

The above outline gives the number of class-room hours per week for each study; the whole number of hours for a period of a week, exclusive of laboratory work, amounts to between sixteen and seventeen hours. The laboratory hours and field work in the subjects requiring it are reckoned at double the class-room period.

In addition to the scheduled course indicated above there will be lectures by the Chief Fire Warden, the State Game Warden, and a number of prominent lumbermen of St. Paul and Minneapolis.

EFFECT OF FORESTS ON WATER SUPPLY.

BY

T. P. LUKENS,

BUREAU OF FORESTRY.

THE effect of forest fires on water supply in the southern California forest reserves, forest clearing and the water flow in streams and springs, and the relative flow from timbered, chaparral-covered, and bare watersheds are problems of vital interest to our people. We have at hand so many illustrations covering all of these features that I hardly know where to begin. I think the most striking demonstration of the

loss of water supply through forest fires is in the San Gabriel Reserve. The San Gabriel River drainage basin comprises an area of 222 square miles. In 1901-'2, after five successive dry years, the minimum flow in the San Gabriel was 90 miner's inches. For the same period the San Antonio River drainage basin, with an area of 26.7 square miles, furnished as a minimum 190 miner's inches.

There being such a great discrepancy

in supply based upon the area, I determined to investigate and ascertain, if possible, the cause. The San Gabriel River drains the very center of the reserve, its west and easterly arms reaching out fully forty miles east and west, with the central channel leading to the valleys of about twelve miles. It is in a position to receive the maximum rainfall, as it is generally understood that in the higher elevations and the central portion of the mountains the rainfall is far greater than on either the valley or the desert slopes. I traversed the entire area, skirting up into the canyons, and I found no place where fire had not burned within a comparatively few years. In many cases the stream beds even were denuded.

One tributary of the East Fork of the San Gabriel, known as the Devil's Canyon, with an area of thirteen square miles, was formerly noted for its fine timber and continuous flow of water. The average altitude of this canyon is about 4,000 feet. Formerly sheep grazing was carried on in this basin, and the inevitable accompanying fires literally destroyed all vegetation, until now there is no conserving power whatever. In fact, nearly the entire area of the San Gabriel River basin has been seriously burned, and in these regions that have been burned so frequently and so severely there is nothing but rocky surface, and it will require very many years for the growth to return. There is perhaps one-third of the entire area that



WESTERN YELLOW PINE FOREST IN SOUTHERN CALIFORNIA.



SCENE IN SAME FOREST ONE WEEK LATER, SHOWING LOPPINGS LEFT AFTER CUTTING; A PERFECT FIRE TRAP.

has not been burned for about twenty-five years.

On the other hand, the San Antonio River basin is contiguous, heading in the San Antonio Mountains, running south, thus receiving the precipitation from the south, east, and west slopes. In this area I found that perhaps one-half of the entire area had been burned within the past fifteen years, while the balance of the area showed little signs of fire. Notably in Bear Creek, with a drainage area of about seven square miles, the timber and chaparral growth was remarkably fine and the humus cover very good. There were no evidences of a quick run-off in the way of debris and scarred trees and but little variation in the stream flow during the entire summer. These two watersheds, if they had been cared for the same—or, in other words, if the fires had been kept out of each, there is no reason why the minimum flow should not have been exactly the same per area. The geological formation of one is identical with that of the other, and in point of geographical position the San Gabriel would

have the advantage, because it takes all of the north and west drainage of Mt. San Antonio, which has an elevation of 10,500 feet, on which the snow would melt very slowly and the run-off would be much more deliberate.

Now, as to the benefit of a stream cover. A few years ago I was with Mr. Joseph Lippincott and another engineer in the country drained by the San Gabriel, at which time we traversed all of its branches. They were making scientific measurements, and I was studying particularly the effect of forest cover on run-off. Mr. Lippincott, at my request, made measurements of the water at the intersection of the West Fork and at a point four miles up the river. This portion of the river and the seepage beds on either side were well covered with willow, alder, and other trees, so that the wind and sun rarely reached the water. Their measurements showed an increase of 38 miner's inches of water in the four miles, showing the great advantage of tree protection to the water flow. Above this point there is a stretch of six miles,

on which there is but little covering, being very rocky and bare. The engineers did not have time to take measurements there for me, but I made them myself as carefully as I could, and I found in the six miles there was a shrinkage of over 20 miner's inches. This certainly was proof to me of the great value of stream covering. During the past summer, while we were gathering spruce seed on the Santa

to be imperceptible. During this period the weather was very warm and clear, and the flow of the stream had declined only one inch in six weeks. Further down the same stream the slopes of the mountain and the stream cover were entirely burned by fire in 1900, doing a vast amount of damage. Extending up the stream for six miles from its mouth, the covering was entirely gone, and there I took measure-



VIEW IN SAN GABRIEL REGION OF SOUTHERN CALIFORNIA, WHERE ONLY SMALL BRUSH IS LEFT ON IMPORTANT WATERSHEDS. FORESTS SWEEPED AWAY BY RECKLESS CUTTING AND FIRE.

Anita Creek, in the San Gabriel Reserve, I had measurements taken by weir in the morning at seven and in the afternoon at four o'clock. Above this point three miles, toward the head of the stream, there is the most perfect covering for both stream and watershed that we know of in southern California, consisting of big-cone spruce and oaks on the slopes, while the stream is covered with alders and maples. We found the variations between morning and evening measurements so slight as

measurements for a few days and found the variation between morning and evening was from 35 to 50 per cent loss in the six miles.

This is quite common. I could go on and give many such instances of loss of water through the destruction of trees and chaparral by fire. Even where watershed areas are well covered, if the stream is exposed to the wind and sun in this hot, sunny climate, the loss is very serious. The relative fall from the timbered, chaparral-covered,

and bare watersheds is very striking. The flow from our timbered watersheds is slow and continuous; from the chaparral-covered areas a greater variation, quicker run-off, and a much less run-off than from the timbered areas in the latter part of the season, showing that less water has been conserved and a greater evaporation has taken place. Bare watersheds on our steep mountain sides retain practically none of the precipitation, but allow it to run off with a rush, eroding the mountains and depositing vast quantities of debris in the valleys.

I will give one more illustration of the great damage to water supply by fire.

Near Pasadena there are two small canyons, from which some years ago an equal amount of water was flowing, being conducted in iron pipes. About 1885 a fire swept over the drainage of one of these canyons. The water supply from this burned canyon decreased immediately, and the season after the fire it ceased to flow entirely. As the chaparral and trees came back the water reappeared, until now the supply, while not equal to the original flow, is on the increase. The water in the canyon that was not burned continued to flow. These canyons are very near together on the south slope of the San Gabriel Reserve.

FOREST FIRES.

THE northwest has been the principal sufferer from forest fires during September, although in most cases not the same territory as that laid waste by the fires mentioned in our last number.

Oregon.—Oregon appears to have suffered more severe loss than any of the other states from numerous fires throughout its area, the most destructive of which was perhaps that near Holbrook, where the loss exceeded \$13,000, according to newspaper reports. This fire gained headway early in the month, and at about the same time the Bull Run Forest Reserve was threatened by a forest fire in the vicinity of Mt. Hood. On September 10, newspaper reports indicated the presence of two blazes in the vicinity of the Cascade Forest Reserve, and by September 17 it was reported that they had inflicted considerable damage to the magnificent timber in that section. After smouldering for several days a fire broke out two miles southeast of Gresham, and in its course toward the Clackamas River destroyed a number of farm buildings and cut and standing timber. A forest fire between Manning and Buxton inflicted damage, and in the vicinity of Clatskanie, Columbia county, scattered fires threatened considerable damage

until extinguished. As late as September 18 it was reported that 3,000,000 feet of green timber had been destroyed along the Sandy River near Ames.

Washington.—After being practically extinguished, the forest fire at Fourth Plain, which, as stated in the September number of FORESTRY AND IRRIGATION inflicted considerable damage, broke out again with renewed vigor, and devastated the country in that vicinity until it was again found necessary, on September 17, to detail soldiers from the Vancouver Barracks to assist in quelling the flames. A continuation of the last month's fires in Pierce county also destroyed property in several localities, and a fire on the headwaters of the Puyallup River shut off all electric power in Seattle for several hours, owing to the destruction of power transmission poles from the power company's plant at Electron. At La Grande, in Thurston county, in a practically unexplored and impenetrable country, forest fires were reported on September 8 to have done considerable damage. Incendiarism is supposed to have been the origin of a forest fire on the Kalama River, which destroyed a large amount of green timber. It is estimated by Seattle newspapers that a loss of \$6,000 in city timberlands was incurred through

a forest fire in the vicinity of that city. A fire reported on September 16 at the head of Lake Washington burned over 7,000 acres of land and destroyed 200,000 feet of lumber, besides burning a logging camp. State aid was extended the Weyerhaeuser Timber Company, and the Cole Shingle Company in fighting fires in township 13 of Pacific county.

Montana.—Newspaper reports indicate that 100,000 feet of lumber have been burned by a forest fire which, on August 25, was making headway toward Saw Tooth Canyon. The forest fires prevalent near Kalispell, mention of which was made in the September number of FORESTRY AND IRRIGATION, have practically been extinguished. The losses are said to have been over \$25,000 in timberlands alone. On August 30 forest fires of considerable magnitude were reported at the head of the Bitter Root Valley, and a blaze in the Deer Creek country, near Big Timber, on lands adjacent to and within the Absarokee Forest Reserve, burned over some valuable pine and fir timberlands. Rain on September 22 practically extinguished forest fires to the west of Anaconda, which had been burning with considerable damage to timber, mining, and quarry property since September 13. Another fire east of Anaconda, presumably started by careless campers, was checked by dynamite after large damage. North of Missoula, on the Rattlesnake, a forest fire is reported to have inflicted loss, and fires extending from the Idaho line to Trout Creek delayed Northern Pacific trains and did minor damage to timber.

California.—A large number of forest fires, some of considerable magnitude, devastated California throughout its area. Most of these occurred from September 7 to 14. Probably the most serious of these fires started early in September in the Santa Cruz Mountains, and newspapers report the loss of three lives and \$100,000 in property, exclusive of extensive damage to timber. Several valuable hotels and summer residences were consumed and much standing timber destroyed in a forest fire that swept from Bolinas Ridge to-

ward the head of Lagunitas Canyon. In Redwood Canyon a bush fire of minor importance developed into a fierce blaze which did considerable damage, placed by newspapers as high as \$75,000. In Alameda and Contra Costa counties it is said that losses will aggregate thousands of dollars, while in Marin county 14,000 acres are said to have been devastated, entailing a large property loss and threatening the destruction of several villages. Fires in Amador, Plumas, and Tehama counties are said to have caused no small damage, while in the Big Basin, in Santa Cruz and Santa Clara counties, a big blaze laid waste a large territory, and for a time threatened the destruction of the famous Big Basin Park. A large area of pasturage has been burned over in Monterey and San Luis Obispo counties; at Cohasset, Butte county; in Sonoma county, near Santa Rosa; in Yolo county, to the west, and in Yuba county, in the Strawberry Valley section, considerable damage has been done. The *Sacramento Bee* estimates a total loss of about \$35,000 from forest fires in the Santa Lucia Hills, near Salinas. A fire at Keswick, California, caused a property loss estimated at \$10,000. Flames swept over Eddy Mountain, in Siskiyou county, doing much damage to valuable timber, and the southern part of Humboldt county is said to have been laid waste. Near San Bernardino, in the vicinity of the famous Arrowhead, forest rangers had difficulty in quelling forest fires.

Idaho.—At Rathdrum, Kootenai county, a high wind fanned a small forest fire into a destructive blaze, which entailed considerable loss. At Spirit Lake, a summer resort 40 miles from Spokane, Wash., considerable damage is reported. At Cœur d'Alene City, also in Kootenai county, some loss was occasioned.

Minnesota.—A forest fire started on August 28 in the dead timber and slashings near Park Rapids and caused considerable anxiety as to its probable result to the town.

Newfoundland.—A continuance of the destructive fires in this province has inflicted large damage. Canadian

papers place the loss as high as \$20,000,000 incurred so far this season. The hamlet of Little Bay was destroyed and two men were killed by a forest fire on August 31.

British Columbia.—It is estimated by prominent lumbermen that \$500,000 loss in timber alone has been occasioned by mid-island fires near Vancouver, and the property loss has been considerable.

Nearly every district in the province has suffered some, and nearly all the government reservations have been visited, with more or less serious consequences. On Howe Sound, in the vicinity of Vancouver, a number of lumber camps, some standing timber, and many thousands of shingle bolts were burned, and it is also reported that four persons succumbed to the flames.

FORESTRY AS APPLIED TO THE DEVELOPMENT OF KANSAS.

BY

GEORGE W. TINCHER.

TO any one who has studied the forest conditions of Kansas, with its meagre supply as compared with the total area of the state, there can be but one conclusion, namely, practically all of the lumber for building purposes must be shipped from adjoining states, and a large portion of the post and pole stock to be used by the farmer must come from the same source. It is true that certain localities in the eastern part of the state, along wooded streams, have an abundance of native timber for local use on the farm, in the way of posts, poles, and fuel; however, only a small portion of the state is so favorably situated. Many of our most productive counties are entirely treeless, and all the timber and fuel must be shipped from the outside. We receive posts from Arkansas, Missouri, Minnesota, and Wisconsin. This is a great drain on the people, because of the excessive freight rate, which is added to the net cost of such stock. Many of the older portions of the state are now using posts and poles that have been grown in the immediate neighborhood. This is a step in the right direction, and one which will have to be followed out, because the demand for all such stock in other parts of the country is becoming great, and the prices will thereby be advanced. I can see only one solution

of the timber problem, so far as posts, poles, and fuel are concerned, and that is to grow them on our own soil and in the locality where there will be the greatest demand.

THE NECESSITY FOR ARTIFICIAL FORESTS.

There can be no doubt about the necessity for establishing artificial forests in Kansas, because of the meagre supply of our native timber. Any experienced farmer who has grown timber of any sort to a sufficient size to be used for posts or poles knows that it is much cheaper and more satisfactory for him to go into a grove and cut the stick desired than to go to a lumber yard and pay cash for the same material.

From fifteen to twenty years ago many artificial forests were established in Kansas. The catalpa is the tree that has been planted more than any other. Some of these forests have not proven a profitable investment, because of the inexperience of those who handled them. The others have paid the owners a larger rent for the ground than they could have secured from any other crop. The Yaggy forest, located near Hutchinson, consists of about five hundred acres of catalpa. The first planting was done in 1890. Posts have been cut from this forest for the last four years,

and the owners do not hesitate to say that it is one of the most profitable crops they ever grew. This forest is located in a treeless district of the state, where there is a ready demand for any supply that may be grown. Many other tree growers can testify to the same fact that applies to the Yaggy forest.

Every land-owner should have a certain portion of his land devoted to forest growth. It would be wise and profitable to reduce the size of the orchard and plant a timber belt on the south and west sides of it. In all probability the owner would procure more fruit from a smaller number of trees that were situated within this sheltered belt, to say nothing of the income received from the forest trees.

An additional reason why artificial forests should be established is that we believe that during the next twenty years Kansas will enjoy her greatest growth. This growth will call for an increased supply of young timber, to say nothing of constant renewals that must be made. All of the present pastures in Kansas will have to be renewed during this time, and the increased acreage of corn, wheat, alfalfa, and other crops will cause the subdividing of many of the large fields of the present day. The demand for small country telephone poles will be much greater than any supply that will be grown. The telephone is one of the things that has come to stay. Every resident of the rural districts will not be content without local telephone service. The dairy interests alone in central and western Kansas will call for millions of posts and poles for fencing and shelter. During this twenty years the present prices will be increased all the way from 25 to 50 per cent, and it seems to me the height of folly to pay this additional cost when we can grow the same material on our own ground and keep the money at home.

LOCATION AND THE BEST SPECIES TO PLANT.

The location of a timber plantation is an essential feature. It should be located where the greatest demand will be when the timber is grown. It would be unwise for a man to plant a timber forest

in the sparsely settled region of Arkansas or in the heavily wooded districts of Wisconsin, but the broad, fertile prairies of Kansas, where the wheat and corn belts come together, is an ideal location in which to grow timber, for the reason that long before this timber is large enough to be used, there will be a demand for it. This would be a good location for the reason that when the product is put on the market the matter of freight will be cut down to a very reasonable rate.

Bottom land will grow trees to a merchantable size in a shorter period than prairie soil. However, we must take into consideration the difference in the price of bottom land and the prairie land. We must also consider that many counties of Kansas have no bottom land, and if the trees are grown at all it must be upon high open prairie.

The Bureau of Forestry, at Washington, D. C., has issued bulletin No. 37, entitled "The Hardy Catalpa," written by Mr. William L. Hall. This bulletin gives an immense amount of information, and deals entirely with catalpa plantations in Kansas. It should be in the hands of every land-owner in the state.

For the eastern half of Kansas I would select catalpa (*speciosa*) in preference to all other timber trees, because this tree has been more thoroughly tested than any other variety. It has more good qualities and less objectionable ones than any tree I know of. It will produce first-class posts in from ten to twelve years, and poles a few years later, while it is almost indestructible in contact with the soil. It is easily worked, will hold staples perfectly, and is tough and strong.

For the central and western part of the state I believe the Russian mulberry, Osage orange, black and honey locust will prove to be quite a factor in the post problem of the future. These trees will grow where it is almost impossible for others to live. They will grow to a suitable size for posts in a dozen years. The mulberry and Osage orange, in order to produce an upright growth, must be pruned annually until the stem is of sufficient length to make a post. Much

of the sand land of southwestern Kansas seems to be admirably suited for the growth of these trees. The black locust is one of the best trees to plant in any part of the state if it was not for the attack of the borer, though in some localities it seems to be immune from this pest.

Mr. Royal Kellogg, of the Bureau of Forestry, has prepared a bulletin, that will soon be issued, on the trees adapted for that part of Kansas and Nebraska west of the one hundredth principal meridian. This publication will be especially valuable for all residents in the western part of the country. The red cedar will thrive to the Colorado line and can be used for ornament and a windbreak, but for post and pole purposes it should be at least from twenty-five to thirty years old, on account of the large proportion of sap as compared with heartwood, the heart being the only portion of the wood that will resist decay. The proportion of sap as compared with heartwood in the mulberry, Osage orange, catalpa, and locust is quite small.

The Austrian, Scotch, and other pines will grow in the West if one has patience and understands how to start them and give proper care and cultivation until they become firmly established.

WILL IT PAY?

Every man who plants trees—or anything else—naturally asks the question, "Will it pay?" I believe that by a

judicious selection of location and the species of trees planted, and with proper care, a timber plantation will pay a larger rate of interest on the investment than the average farm crop. It is true that if every owner of land planted it to timber the profits would be very much lessened; but only a small proportion of men will plant a crop for which they must wait from ten to twelve years to realize a profit. The greatest profit to be derived from an investment of this sort is that it is permanent. When a plantation is once established and the crop is removed, a second crop can be grown from the stumps in much less time than the first and produce a better grade of timber than the first one. The Osage orange and catalpa are the most persistent sprouters on the list.

It will pay not only in a financial way, but it pays in the sense of being a benefit to the community in which one may live. It will pay as a shelter for hogs or cattle from the cold northwesterly blizzards that sweep over the state annually. It will pay many times the cost by providing shelter for a herd of cattle during one of these terrible storms. From my experience of almost twenty years in growing timber trees, I feel perfectly satisfied that it has paid me; and if I had the means, I would plant one or two thousand acres to forest trees within the next few years, because I firmly believe that long before 1920 every owner of timber will find a ready market and a good price for anything that he may offer for sale.

TRACK SUPPLIES AND TREATED TIMBERS.

NEW FORM OF RAILROAD TIE RECOMMENDED BY THE BUREAU OF FORESTRY.

THE annual consumption of ties on 203,132 miles of railroad track in this country is 114,000,000, and it is yearly becoming harder to meet this demand. Granite, metal, and, more recently, concrete ties have been experimented with, but nowhere permanently adopted, and the indications are that wooden ties are not soon to be displaced.

The Bureau of Forestry has for some time been making studies and experiments designed to improve the present conditions and to prevent the exhaustion of the timbers from which ties are made. Bulletin No. 50, "Cross-Tie Forms and Rail Fastenings, with Special Reference to Treated Timbers," by Dr. Hermann von Schrenk, which has

just been published, gives the latest results of these investigations.

The manner in which ties have hitherto been made has been determined largely by the ease and rapidity with which they could be cut. They have been obtained from trees of all diameters, from 9 inches upward, the most serviceable portions of live straight trees being selected. The sapwood top sections and trees killed by fire, insects, disease, etc., or blown down, could not be utilized, owing to the fact that ties from sapwood or dead timber decay rapidly.

Although large ties make a better roadbed than the same amount of timber in a greater number of small ties, the first consideration is to have as great a bearing surface as possible on the ballast. A trapezoidal or modified half-round tie, with a base of 10 to 12 inches and a top-bearing surface of 6 inches, distributes the weight of moving trainloads upon the roadbed as effectually as a rectangular tie 10 to 12 inches broad. The half-round tie is good for the lumberman, because in numerous instances two ties of this form can be made from a log which would furnish but one rectangular tie; in other cases material for several boards is saved where a rectangular tie would have taken the entire log. This form is beneficial to the forest, since it encourages the cutting of large trees and the saving of small ones until they reach more valuable size, and permits the utilization of much timber from the tops, hitherto left in the woods. The half-round tie is advantageous from a mechanical standpoint also, because it gives greater bearing surface per mile and a correspondingly more stable track than rectangular ties. This tie form is therefore advocated by the Bureau of Forestry as economical of timber, conservative of the lumber supply, and at the same time equally efficient with the forms in common use.

Ties are commonly graded as first, second, and third class, and culls, or ties which either in size or in quality fall below the specifications, but which the railroads generally accept up to a certain percentage of the total number of ties, though at a greatly reduced price.

There is, however, no accepted standard as to what constitutes a first, second, or third-class tie, and the specifications of the various railroads show wide differences in the dimensions required. It is proposed by Doctor von Schrenk that a standard classification be adopted, consisting of six or more classes, to be known as A, B, C, etc., each class to be of a definite size, and no provision to be made for culls. This will tend to economy, since the smaller-sized ties will fall into the smaller classes and will be sold at their market value to the roads which want them, instead of, as largely now, to roads which do not want them, but, having received a certain proportion of them mingled with those of the specified size, do not feel warranted in rejecting them altogether. This proposal has been adopted by the American Engineering and Maintenance of Way Association.

A far greater economy, however, than can be hoped for from the adoption of a new tie form or a new tie classification is that promised by the studies which the Bureau of Forestry has directed toward opening new sources of supply of ties. This it aims to do by making possible the utilization of cheaper and more abundant kinds of timbers in place of the high-grade woods now employed. The commonest as well as the best tie material of the past and present in this country is white oak, which resists both wear and decay excellently, and is consequently cheaper in the long run than less expensive woods like beech, red oak, or loblolly and lodgepole pine; but white oak, besides being one of our finest timber trees, is becoming high-priced, and further, as railroad men know well, is becoming scarce even faster than the advancing price would indicate. Not only is it very wasteful to make ties of white oak, which can be manufactured into much more valuable products, if a lower-grade wood will do, but soon, under the present demand, white oak ties will no longer be obtainable in the required quantity at any price.

The first step in the search for substitutes was to discover how to prevent rapid decay of softer woods when laid in the track. Preservative treatment

has long been in general use abroad. With proper methods it can be made entirely successful, and impregnation with creosote, zinc chlorid, or other antiseptic substances allows the use of many woods hitherto passed over, as well as of sawed ties, sapwood, and dead timber. Preservative treatment can make a beech or red oak or pine tie outlast a white oak tie. But the wearing away of the softer fibers of these woods under the rail and around the spike raises a new set of problems. Even with cheap treatment practicable, which insures against the destruction of the tie in the ground by decay, it is neither economical nor safe to equip a road with such ties unless mechanical devices can be found which will prevent rapid wear. Ties chemically treated resist decay, but the softer woods can not withstand wear of the rails nor hold the spikes under the heavy traffic of American roads.

This is true not only of ties upon which the rails rest directly, but also where the old forms of steel plates inserted between rail and tie are used. Indeed, the thin plates with prongs or spines and flanges, hitherto generally used in the United States, appear to hasten rather than retard wear of the tie. With accompanying screw-spikes, which hold the rail firmly to the tie, several forms of plates can be introduced successfully. Wooden tie-plates can be used, which, when worn out, are easily replaced.

The functions of spikes are, first, to hold the ties to the rails, and, second, to prevent the rails from spreading. Nail spikes are still used for this purpose in this country. In driving a spike into a

white-oak tie the strong and elastic fiber of the wood is bent downward, maintaining a close contact, so that powerful resistance is offered to its withdrawal. When driven into such woods as hemlock and western yellow, lodgepole, loblolly, or shortleaf pine, the fibers of the wood are crushed and broken. As a result the spikes do not hold with sufficient firmness to withstand the undulatory motion of the rail nor the lateral pressure against them. They become loosened, and the constant friction enlarges the spike-hole until water collects in it and decay begins. The spike must soon be driven in a new place, and this constant respiking rapidly ruins the tie. Even if the tie has been treated with a solution like zinc chlorid, the water will leach out the salt, so that decay-producing factors begin their work. The solution of this difficulty is achieved by the use of a screw spike. In the soft woods screw spikes will resist nearly three times as great a strain as nail spikes. If inserted in a screw dowel of hard wood, the power of the screw spike is still greater. A key operated by two men, a hand-power screw-spike-driving machine, or a machine with electric power may be employed to insert screw spikes.

Arrangements are being made for the extensive introduction of these appliances, the need of which has developed so conspicuously in the brief experience with treated timbers. If in the maintenance of a stable track, so indispensable for the safety of trains moving at a high rate of speed, the proposed equipment fulfills the promise of experimental tests, an important step in the better utilization of our forest resources will have been made.



THE RANGE PROBLEM.

A DESCRIPTION OF THE STOCKMAN'S HOMESTEAD
AND GRAZING RANGE ADMINISTRATION IN THE
WEST, WITH SUGGESTIONS FOR ITS IMPROVEMENT.

BY

PROFESSOR R. H. FORBES,

DIRECTOR OF ARIZONA AGRICULTURAL EXPERIMENT STATION.

THE industrial condition which governs throughout more than 400,000,000 acres of western public grazing lands has been described many times recently in articles discussing the question of the proper disposal of these lands. In general, the situation is everywhere the same, temporary occupation without ownership or legal possessory rights by stockmen of that public domain whose purpose is to provide room and opportunity as long and as fully as possible for the nation's rapidly expanding population.

Mindful of such an important utility for our public lands, any damage to the national asset must be considered, virtually, as a sacrifice of national territory, inasmuch as its impairment means the loss of so much foothold and working room for prospective settlers. Yet exactly this has been the result of the misfit application of existing land laws to western conditions. These laws, virtually inoperative in a grazing country, have necessarily been supplemented by the unwritten law of the range, framed and enforced by those strong enough to take and hold possession for a brief term of years.

EFFECTS OF OVERGRAZING.

The result of such occupation is, usually, that excessive numbers of animals are put upon this free pasture, the profits are run up as quickly as possible while yet the range remains free, and then when the grass is gone, when the plains and hillsides are converted into gullied barrens, and oftentimes, when the profits of the first years are canceled by the losses of later ones, the nation's ruined estate is abandoned to the tender

mercies of the next and more ruthless occupant who may still find something convertible thereon.

The effect of this unregulated and destructive tenure varies greatly with those conditions of soil, topography, rainfall, heat, and frost which affect the endurance of a grazing country. More favored districts in more northerly, humid, or elevated situations still retain an important fraction of their primeval value; but in portions of the southwest where the soils are sandy and easily washed, where the rainfall is light and often untimely, where the hot, dry climate causes enormous evaporation, and where, consequently, the effects of unregulated grazing are most destructive, many great areas of formerly grassy country may be safely stated to be capable of supporting not one-tenth of the stock that once ranged there.

APPROXIMATE LOSSES.

It may be assumed, probably without exaggerating the loss, that the public grazing ranges of the West now average not more than half of their original value—lands, too, which can never be irrigated and for which there is no possible use but as grazing territory. Differently stated, this means that the United States, for want of proper laws to govern its public domain, has suffered a loss equal in effective value to, say, 200,000,000 acres of grazing lands, an area greater than the state of Texas or equal to a strip of territory 230 miles wide extending from the Rio Grande to the Canadian boundary. It is evident that only the wreckage of western grazing values remains to be legislated

for, and that the problems of the now depleted range are largely those of reconstruction for a failing country, occupied by more or less conflicting interests, by cattle, sheep, and goats, by large companies, and by small individuals.

There are few remaining to defend the old order of "free grass for all," for this regime, satisfactory enough when there was grass for all, has, with the failure of the ranges, demonstrated its own ruinousness.

THE NATURE OF THE PROBLEM.

The problem confronting range interests at this time is to devise land laws which shall enable a maximum population to support itself in a pastoral country, and to make these laws so flexible as to apply to all grades, both best and poorest, of grazing lands, harmonize all kinds of stock interests thereon, and provide for the often unexpected development, through irrigation, of agricultural lands within formerly purely grazing districts.

The existing conditions are those of a country reduced by overgrazing and bad management to a fraction of its possible value, and requiring to be fenced, reseeded, repaired, and protected in order to even partly restore that value.

UNSATISFACTORY REMEDIES PROPOSED.

Practically the only proposals thus far made to remedy existing conditions are to lease the public lands in blocks at stated rents, or to issue permits to individuals to run stated numbers of animals upon specified portions of the public range.

The unsatisfactory nature of these proposals is attested in part by their repeated rejection by one or another faction of those concerned, and for reasons quite evident when the merits of the measures are considered. Lease or fence laws permitting the control of large bodies of land on the basis of competitive bids are usually favored by the wealthier and better established stock-raisers, who would be at an advantage under such laws, and are earnestly opposed by the small men, who would be exterminated through their operation. Horizontal lease laws have been pro-

posed providing for the leasing of all grazing lands at the same rate per acre of rental. When it is considered that different grazing districts may easily require all the way from 3 to 60 acres to support a single cow, the unjust discrimination against the more desert ranges of a horizontal rate-per-acre lease law is too evident to require discussion.

The leasing idea, nevertheless, has a good foundation in the fact that it recognizes that in order to place the grazing industries on a stable basis, *stockmen, like farmers, must have control of the land upon which they operate*; but methods have not yet been proposed for an open and equitable division of grazing lands among applicants therefor.

The permit system, also, in one form or another, has many advocates—possibly largely for the reason that this method has been put into practice on forest and Indian reserves, and its results are known to those who would expect to take advantage of it. The permit system, however, is practically no better than free range with a tax added to the stockman's expenses and a more or less unsuccessful attempt on the part of the government to regulate the number of animals in a specified district. As under the free regime the stockman is not protected by assurance of permanent or long-continued tenure of his range, he consequently desires to get the whole value out of his concession while it lasts, and often yields to the temptation to place more animals upon his territory than his permit calls for. The destructive effects of the permit system as they are to be seen on certain Arizona reservations are not reassuring as to the good results of this method in practice.

AUSTRALIAN EXPERIENCE AND RESULTS.

It is doubtful, in brief, that a satisfactory method of disposal for western grazing ranges and their use as such has been devised, and we naturally turn at this time to Australia for suggestions. This country, which is and always has been more a pastoral than an agricultural region, for the last 75 years has been making and remodeling her laws

relating to the disposal of crown lands to settlers. The fruits of this long experience are of unusual significance to us at the present time. As they now stand, the land laws of various of the Australian states present the following sensible features: First. Grazing lands are divided, according to their capacity to carry stock, into as many as four classes, and settlers are permitted to occupy smaller or greater allotments of territory according to its quality. Second. These lands are occupied under long tenure leases, with renewal privileges, which give practically permanent control to the stockmen. In addition to the motive thus created to improve their leaseholds, they are also usually required by law to fence and otherwise improve their holdings. Third. The classification of lands and their allotment to settlers is done by boards of commissioners acting for the government, with a view to correct judgment and equitable division of public lands.

These are the leading features of those laws which have resulted from the better part of a century of Anglo-Saxon experience in a pastoral country.

The operation of these laws with reference to the development of pastoral industry is stated to be highly satisfactory. Vast areas of semi-desert lands, divided into comparatively small holdings, are legally occupied for long terms by stockmen who, prompted both by law and their own best interests, improve their holdings. Thus it is that in Australia an immense pastoral country has been fenced, substantial improvements are installed, provision is made against famine in dry years, animal pests are exterminated, poisonous plants are eradicated, and an era of improvement has apparently been inaugurated *directly due to a recognition of the fact that the Anglo-Saxon must have proprietary interest in land if he is to be expected to improve its condition.*

In unhappy contrast to the upbuilding of pastoral Australia is the reverse process everywhere evident in our own Western States. The spoliation which has resulted inevitably from the lack of laws having for their object a saving administration of the range country has resulted in a gradual but sure decline

of its carrying capacity. In some districts, especially where, under stress of overgrazing, the soil is easily eroded by rainfall, this damage can never be repaired; in others, restriction of grazing, reseeding, and other remedial measures may effect a large measure of restoration.

As to what these remedial measures shall be in the United States there is, of course, great difference of opinion, influenced in part by the interests of those concerned and in part by ignorance of the problem itself.

PRINCIPLES ON WHICH SOUND GRAZING LAND LAWS MUST REST.

Successful grazing range laws must of necessity rest upon two kinds of knowledge—knowledge of the range itself, the forages that it bears, their habits of growth and reproduction, their food value for animals, the classification of grazing country into different grades, and the carrying capacity and endurance of these different kinds of range. This is a subject the study of which within the past few years has been vigorously entered upon by various economic botanists, especially by certain of the state experiment stations and by the United States Department of Agriculture.

The second sort of knowledge required is that derived from legislative experience in dealing with purely grazing lands elsewhere. The results of such experience are to be found in Australia probably more than in any other modern country.

Australian experience, considered together with the traditions of our own land laws, points to the practicability in the United States of the stockman's homestead or long-term leasehold in pastoral districts. The homestead idea, long tried and well approved in this country, is, briefly, that a settler shall be granted enough territory to afford him a living—enough and no more.

THE MEANING OF THE HOMESTEAD.

As applied to the Mississippi Valley, a homestead meant 160 acres of land, this area being found in the average instance sufficient for a farming family; but when the tide of immigration pushed

west of the 100th meridian into the semi-arid regions, it was found either that 160 acres with water were worth a great deal more, or that 160 acres without water were worth vastly less than that same area back in the Mississippi Valley.

The far greater value of irrigated lands has been recognized and provided for under the terms of the Newlands act, and, according to the productive capacity of the lands developed by the Reclamation Service, the settler will be granted a greater or less portion adequate for his support.

Continuing the application of the idea, why should we not apportion grazing ranges on precisely the same principle, granting a sufficient acreage for a sufficient time to afford the small stockman the necessary territory to support the herd whose increase shall give him a living income and protecting him in his tenure for a sufficient length of time to create an incentive for the maintenance and improvement of his range?

In Australia, from 1,280 to 40,000 acres of grazing lands, according to quality, are thus leased, at rates proportionate to value, for terms of from fourteen to forty-two years. Many benefits are experienced under these provisions. Sheep and cattle wars are rendered impossible, since each interest is confined to its own territory. Coöperative arrangements are entered into extensively where coöperation permits of more economical management of large adjoining leaseholds. Grazing leaseholds are operated in connection with cultivated farms, and

humane methods of handling stock are rendered possible.

SOME SUGGESTIONS.

The operation of the grazing leasehold plan implies the creation of a suitable means for classifying grazing lands according to their productive capacity, and designating the various areas in different districts which will support, without destruction of the range, the income-producing herd of the small stockman.

Proper provision for residence upon and improvement of holdings should be made, insuring good faith of occupants and varying with conditions in different districts.

Coöperation should be recognized and provided for in districts where the sparseness of the range, the scarcity of water, and the comparative costliness of fencing makes it advisable for neighbors to act jointly.

Provision should be made for the renewal of a long-tenure lease by the original holder, provided the land remains purely grazing country; but in case of possible artesian or irrigation development provision should also be made for throwing the leasehold open to more intensive culture.

On these and other concurrent lines, as seems to have been demonstrated by the Anglo-Saxon sheep and cattle men of Australia, it should be possible to fulfill the purpose of our public domain and place upon it a maximum number of American citizens secure in their rights to sufficient territory to secure a living for themselves.

WOODS OF THE PHILIPPINES.

BY

EBER C. SMITH.

IN a previous article, referring to the forestry display by the Philippine Islands at the World's Fair, the narra wood was particularly described, it belonging to the superior group and first in general use for fine furniture, doors,

casing and flooring in the better-appointed dwellings.

A number of slabs, finely polished, in the Forestry Building and the handsome tables in it and various other buildings in the Philippine reservation are beauti-

ful specimens of narra. The piano in the Administration Building is also built of narra wood.

In my former article narra was called the mahogany of the Philippines, quoting Foreman, but on account of its close resemblance, texture, and specific gravity, it seems it would better be entitled to be called the "rosewood of the Philippines." It is eighth among the woods of the islands in resistance, twenty-third in elasticity, and thirty-first in specific gravity.

Of the fine woods of the superior group, calantas is the next in importance to narra. Of this wood there is an excellent display in the Forestry Building. The two large slabs, 39 x 5.1 feet and 4 inches thick, highly polished on one side, are magnificent samples of the calantas wood. From this and other specimens on exhibit the World's Fair visitor can form a good idea of its importance. It is fairly distributed over the islands and is worth from 5 to 6 cents per square foot on the beach where it is cut and 35 cents delivered in the log at Manila—\$100 per 1,000 feet linear measure in lumber in Manila. While these are the classified prices, they should not by any means be taken as a basis for business calculations.

With proper transportation, modern methods of chopping and handling logs, and good sawmills, taken together with the cheap labor that can be had in the islands, there is no reason why the fine woods of the Philippines might not be placed upon the markets of the world at a lower figure than similar woods from other countries.

Calantas grows principally on the islands of Luzón, Mindoro, Negros, and Paragua.

Of all the woods of the first order, calantas is first in elasticity, and is therefore most valuable for small boat building, for making cigar boxes, and ordinary constructions.

Of specific gravity it is forty-first, and for resistance there are 46 other woods rank above it. It is sometimes erroneously called cedar in America, on account of the close resemblance to the South and Central American cedar wood. It varies in shades from a blood red, black red, purplish red, to an ashy rose. It is not much subject to attacks of insects and is very durable.

The calantas is fragrant, and when burning emits an odor similar to that of juniper.

Molave, christened the "Queen of Woods" by the Filipinos, also belongs to the superior group, and grows wild in Cebú, Leyte, Luzón, Masbate, Mindanao, Mindoro, Negros, Panay, Paragua, Samar, Sorsogon, and many other islands. It is well displayed in the Forestry Building. It is worth upon the beach where it is cut 10 cents per square foot, 80 cents delivered at Manila, and \$145 per 1,000 feet of lumber. It is probably the most common and best known hardwood in the Philippine Islands.

The texture is fine and grainy and susceptible of a fine polish. It is of great value for building purposes on account of its great strength and being exempt from decay. It is cut into magnificent plank, and is used for flooring, door panels, and other furnishing and finishings in the construction of the better class of buildings. It is used in shipbuilding for everything excepting the keel. It is excellent wood for statues and other ornamental woodwork, as it is not subject to the attacks of insects, which deface and destroy many kinds of wood in the Philippines.

There are great opportunities for making money by handling the fine woods of these islands for the markets of the world.

A finer display of different kinds of woods has probably never been made than that contained in the Philippine Forestry Exhibit at the World's Fair.



PROPOSED IRRIGATION LAW.

DRAFT OF STATE IRRIGATION LAW TO BE SUBMITTED
TO LEGISLATURES OF WASHINGTON AND OREGON.

IN the September issue of *FORESTRY AND IRRIGATION* reference was made to the draft of a state irrigation law prepared by Mr. Morris Bien, of the United States Reclamation Service, at the request of irrigation commissions of the States of Oregon and Washington, appointed for the purpose of submitting draft of such a law at the next session of the legislatures of the two states. Copy of this pamphlet has now been received.

It is based upon the principles recently developed under the best irrigation practice, some of which are now incorporated in the laws of Idaho, Nebraska, Utah, and Wyoming.

The whole code is founded upon the principle of beneficial use as the essential feature of a claim to the use of water. It recognizes the waters of the state as the property of the public and subject to appropriation under a regular and orderly procedure as prescribed by the law. The rights which have already become vested, either by means of appropriation or by use under a claim of riparian right, are recognized as valid, and all claims to the use of water not applied to a beneficial use at the date of the act will be recognized as relating back to the date of initiation of the claim if the necessary surveys and construction for the application of the water to a beneficial use are diligently prosecuted to completion.

The draft provides for a state engineer, to be appointed by the governor and affirmed by the senate. He is to hold office for the term of six years, which makes his office as independent as possible of the political administrations, as he will hold over through one full administration. The draft provides that no person shall be appointed to this office except a technically qualified and experienced hydraulic engineer.

A large part of the cost of administration of this law will be paid by the

fees of the state engineer's office, which are turned into the general fund of the state treasury. These fees are very reasonable for each individual case, but the development of irrigation in these states will unquestionably afford in fees a very large part, if not all, of the cost of administration.

A number of sections are devoted to the determination of existing water rights. This is an important feature, as the present conditions in these states are very unsatisfactory, inasmuch as the claims to water are based on both appropriation and riparian rights, in some cases claims of both classes being asserted as to the same stream.

The state engineer is required to make a hydrographic study of each stream, obtaining the necessary data for the determination of all water rights. The results of such survey are then transmitted to the attorney general of the state, who is required within thirty days to enter suit for the determination of all rights in such stream system.

The appropriation of water is to be made under rules and regulations of the state engineer as limited by the provisions of law.

An important provision in this connection is that before a permit to appropriate water is issued by the state engineer the applicant is required to publish notice, containing all essential facts as to the proposed appropriation, in some newspaper of general circulation in the locality where the water is to be diverted or used.

After the completion of the work the state engineer is required to inspect it and then gives a certificate of construction, specifying the capacity of the works, and the right of appropriation is limited to such quantity.

It is required that the construction of the works shall be diligently prosecuted to completion, and if one-fifth of the work is not completed within one-half

the time allowed, it becomes possible for other applicants to obtain a right to the water which had been set aside for that work.

When the water has been applied to a beneficial use a license is issued by the state engineer, and the right to appropriate water then becomes fixed as to quantity and conditions.

Provisions are found in this draft for the recording of all water rights and documents relating thereto in the office of the state engineer.

A provision of considerable importance to the future development of these two states is found in section 36, which requires the state engineer to reserve from appropriation the waters which may be found necessary by the United States in developing the projects under the Reclamation Act. Other provisions place at the disposal of the Reclamation Service, at minimum cost, the lands of the state which may be needed for irrigation works and require coöperation with the government in the disposition of the state lands which may be subject to irrigation under works constructed by the Reclamation Service.

The state is to be divided into water divisions, probably four in number, and a water commissioner is to be elected in each division. These commissioners are vested with authority to regulate the apportionment of the waters in accordance with the adjudications of the courts and the permits issued by the state engineer. The water commissioners are specially required to guard against waste and to see that each appropriator of water receives the amount to which he is entitled. Water masters are provided for, to act under the supervision of the water commissioners in carrying out the details of their work.

The state engineer and the water commissioners form a board of water com-

missioners, who are vested with general supervisory authority over the various details of appropriation and distribution of water.

The expense of administration in regard to water apportionment by the water masters is borne by the ditch owners and the water users.

Under the head of miscellaneous provisions are sections defining the units of measurement. The cubic foot per second is adopted for measuring the flow of water and the acre-foot for measuring the volume. An important feature is a definition of the miner's inch as the equivalent of $\frac{1}{50}$ of a cubic foot per second except where otherwise determined by contract or usage.

A section is devoted to the provision for severing the use of water from land to which it is appurtenant for irrigation purposes. This can only be done upon the approval of the state engineer after due publication in newspapers of the intent to make such change.

Another section is devoted to the question of seepage water, which has been in many cases the subject of much difficulty and litigation. This provides that the party who proposes to use water which can be definitely traced as seepage from some particular canal or reservoir will be required to make reasonable payment to the owner of the irrigation works from which the water is derived.

There are many details in this draft—some of them being wholly new—that would be profitable to consider if space were available. The summary given, however, will enable the reader to see that the draft prepared for the consideration of the legislatures of Washington and Oregon will enable those states to place themselves in the foremost rank in the development of irrigation legislation if its principles are adhered to.



TO HARNESS THE MISSOURI.

PLANS LOOKING TO UTILIZATION
OF ITS WATERS FOR IRRIGATION.

BY

GUY ELLIOT MITCHELL.

TWENTY-FIVE years ago Major J. W. Powell, the greatest American irrigation authority, told the people of North Dakota, at their constitutional convention, some plain facts about this semi-arid section which they were then loth to believe, but which have since proven only too true. He told them that in the western portion of the state they would have to depend upon irrigation, and that in the eastern part they could grow good crops with natural rainfall, but that in the middle portion an entire dependence upon rainfall must ultimately bring disaster; that they would have a series of years when there would be abundant crops, and then for a number of years there would be scant rainfall, when crops would fail and disaster and discouragement would overtake thousands of people. Up and down the temperature of agriculture would rise and fall with the seasons—the lean years and the fat. “You will,” he said, “hug to yourselves the delusion that the climate is changing. This question is 4,000 years old. Nothing that man can do will change the climate. There is almost enough rainfall, but one year and another you need a little more than you get. It is flowing past you in your rivers.”

These words seem truly prophetic as the history of the Dakotas for the past 25 years is reviewed. The lean years came and the fat years, the years when there was plenty of rain and the soil produced abundantly, and the cycles of lean years came, when the farmers watched in vain for the fructifying rainfall and their crops burned to a brown and a crisp, and finally they abandoned their homes by hundreds and by thousands.

For three years in succession during that period, I was told, land which be-

fore and since yielded 20 bushels of wheat per acre produced but two poor bushels, while thousands of acres were never even harvested.

A WASTE OF WEALTH.

And the wealth of an empire is going by in the rivers, as Major Powell stated—flowing uselessly to the ocean. That is apparent enough to any one visiting the country. How to get the water onto the land is the question. For the very reason that dry farming may succeed but little interest has been taken in irrigation. But the farmers of North Dakota are awakening. They are realizing that it is a false pride which proclaims that irrigation is not needed, for with irrigation they will have a safe and sure crop and one vastly more productive. The business men, too, are beginning to see that small farms, intensively cultivated and made to produce the maximum yield, contribute much more to the growth and upbuilding of the state than do large ranches, half farmed, or wild hay land.

THE FORCEFUL MISSOURI.

A certain Western Senator, in a cloak-room conversation on irrigation last winter, stated it as his belief that the Missouri could be dammed at various points and all its flood waters saved for irrigation. This statesman was from the far, far West, where all things are easily possible. The Missouri is a vast yellow giant. It flows through North Dakota, even in low water time, a titanic mill-race, in which a strong swimmer may perhaps trust himself, and be swept down stream as fast as a man can run. In flood, when the Rocky Mountain snows are melting, it is the embodiment of power, if not destruction, tossing its tawny mane as it sweeps before it mil-

lions of tons of earth, cutting out new channels and building up new lands miles and miles in extent. Some day it may be possible to put in a great dam a couple of miles wide at one or two points where the river is confined between high sandstone bluffs; but this would be a work which, while it would create a great empire of its own, would make the Nile dam, with its 25 millions of cost, sink into comparative insignificance.

WHAT CAN BE DONE TODAY.

But there are other means of making the Missouri contribute to American prosperity. The writer was fortunate enough to take a trip of some hundred miles up the river on a steamer piloted by the last of the old-time river kings, Captain Grant Marsh, famous as a pilot and river explorer under Custer, Forsythe, Sheridan, Miles, and an important factor in many Indian expeditions. There was little in common in my uneventful trip and such a one as when Captain Marsh brought back to Bismarck the first news of the dreadful Custer massacre, which made 26 widows of army officers stationed at Fort Lincoln, just across the river, and brought likewise a score of wounded soldiers from Reno's detached troops. The Sioux have had their passing and ranchers and farmers may dwell and till without fear of swift annihilation from marauding braves. But from the pilot-house of the little steamer I could discern, in the not far future, a development along the Missouri which would work a yet greater change than that of the past decade. For hundreds of miles the river is encompassed by steep bluffs from 200 to 250 feet high and from 2 to 3 miles apart. Between these the river winds, a stream of from a quarter to a half mile wide, gradually changing its course from side to side, but forming great areas of "bench" lands 20, 30, and 50 feet high—hundreds of thousands of acres of surpassingly fertile soil, needing only irrigation. And the watering of this land turns out to be among the easiest of projects.

Every bluff of the Missouri showed a coal vein of from 6 inches to 12 feet in

thickness; in fact, enormous areas of North Dakota are underlain with splendid lignite coal, worth at the mine only a dollar a ton. There you have it. The water of the Missouri, a limitless, ceaseless supply, just above it land made by centuries of river sediment, and immediately at hand one of the cheapest known fuels to pump the water onto the land. It did not take an engineer to see the feasibility and cheapness of this undertaking.

But why, I asked myself, had it not been done? Why had not farmers themselves put in windmills and small pumps? Was there, after all, some insurmountable obstacle? No. Talks with a few of them showed them as ignorant of irrigation and its simplicity as are the farmers of Vermont. In fact, they were "rainfall" farmers and they spoke of irrigation as a mysterious and complicated process.

UNCLE SAM TO PUMP THE MISSOURI.

My return to Bismarck justified my conclusions. I found two government engineers even then investigating the problem, and, far beyond supplying the great areas of lower benches, they propose to elevate the water a hundred and possibly 200 feet out onto the great mesas. I left them, preparing for a trip down the Missouri from the Dakota-Montana line, in a small skiff, on a careful reconnaissance of the Old Muddy, its tributaries and its lands. If they find conditions as favorable as they would seem, a party of surveyors will be put upon the project at once to make surveys and detailed plans, to be followed by the installation of giant pumps, water engines, each of which will create a small river.

This work of the government is fraught with unbounded possibilities for North Dakota. A great empire lies latent in the midst of the state, the worth of which her own people are but beginning to comprehend. The fertility of the ages is stored in the ink-black soil and the water of half a continent flows by, an unused agent of wealth.

The day of great things for the land of Laughing Water may be close at hand.

RECENT PUBLICATIONS.

Elementary Wood Working. By EDWIN W. FOSTER. Pp. 133. Illustrated. Ginn & Co., Boston.

This little volume has for its purpose the furnishing to high-school and other students the essential facts about tools and their uses. It not only describes, but illustrates, the various tools used in wood working; and there are chapters on lumbering and milling. The principal timber trees are also described. Altogether the volume contains much information of a practical nature that should be useful to the average person.

Our Mountain Garden. By Mrs. THEODORE THOMAS. Pp. 212. Illustrated. Macmillan Company, New York. \$1.50 net.

Mrs. Thomas' experience in producing her mountain garden, which included the building of a summer home, will delight and be profitable to both those who are amateur gardeners or who contemplate becoming such. The desire to build a home and beautify its surroundings has ever been strong in the average breast, and never more so than in recent years. The desire to "personally conduct" the operations seems to be the rage, and a right healthy sign it is. The whole work in connection with Mrs. Thomas' house and garden was superintended by and much of the labor done by herself. It is for this reason that her narrative is so interesting and full of practical hints. The book is delightfully written also and in many ways it suggests Arthur Henry's admirable volume, "The House in the Woods," with which it does not suffer in comparison.

Getting Acquainted with the Trees. By J. HORACE MCFARLAND. Pp. 241. Over 100 illustrations. Macmillan Company, New York.

This volume contains eight chapters in popular vein on some of our best-known trees. Mr. McFarland's connection with the book as author, illustrator, and printer is sufficient guarantee as to its artistic side. It is undoubtedly one of the handsomest nature books we have seen, and as a guide to certain classes of our trees will be of much value to amateur dendrologists. The illustrations, numbering more than one hundred half-tones from photographs, are striking examples of the engraver's and printer's skill.

Weather Folk-Lore and Local Weather Signs. Bulletin No. 33, U. S. Weather Bureau. By Professor EDWARD GARRIOTT. Pp. 174. Illustrated with maps. Government Printing Office. Price, 35 cents.

This is an interesting as well as a valuable publication, the first part classifying all the "sayings" and legends of the weather in so far as they hold true, and the second containing summaries of local weather signs at Weather Bureau stations throughout the United States as indicated by the reports of the Bureau's observers. The mass of weather folk-lore has been threshed out until only those legends or sayings which have been found true in practi-

cal application, in whole or in part, remain. These are further classified with explanations and notes, under the heads of Wind, Clouds, Barometer, Temperature, Humidity, Animals, Birds, Fish, Insects, Plants, Sun, Moon, Stars, Sun-spots, Days, Months, and Years, etc. Sayings, legends, tales, and folk-lore concerning the weather that have been handed down from generation to generation by French, German, Swiss, Scottish, and other foreign peoples, together with the writings, prose and poetic, of their languages, and the ancient couplets, quaint legends, and curious rules from our own ancestors are given, with explanations of their meaning and how nearly true they prophesy. The second part of the book is intended particularly for the amateur meteorologist, and contains the material submitted by the Bureau's observers throughout the country on which predictions are based.

Floods of the Spring of 1903 in the Mississippi Watershed. Bulletin M, U. S. Weather Bureau. By H. C. FRANKENFIELD. Pp. 63. 15 charts and numerous half tone illustrations. Government Printing Office. Price, \$1.00.

The floods of 1903 in the Mississippi Valley resulted in immense general damage to property in that vicinity, and this publication is a discussion of their causes and effects, arranged by localities, with a general description of their courses, and with special reports bearing on the subject. The illustrations, two of which are reproduced in this number of FORESTRY AND IRRIGATION, portray graphically the tremendous damage wrought. It is an exhaustive summary and history of the entire flood, and a number of charts showing precipitation during periods preceding and during the flood, with other data, are appended. The report is particularly valuable in that it contains the official figures and tabulations of the rise and fall of the flood and the losses and technical reports of the Weather Bureau's trained staff.

Proceedings of the Iowa Park and Forestry Association. Third Annual Meeting. Pp. 173. Illustrated. Published by the Association. 1904.

About twenty-five valuable papers, delivered at the Third Annual Meeting of the Iowa Park and Forestry Association, held on December 7 and 8 of last year, are preserved in this volume. The Association is doing much to encourage the practice of forestry in Iowa and education in its principles, with the creation of national parks and preservation of game, and the papers of this meeting are for the most part on these subjects or their special phases and applicability to certain conditions. The contents are divided into the business of the meeting proper, with minutes, and the papers read, classified under Forestry, Parks and Grounds, Schools and the Trees, and The Esthetic Side of Forestry. Numerous illustrations amplify upon the text, and the whole makes one of the handsomest volumes of its kind that has been received.

Foresters and Inspectors Wanted for the Philippine Forestry Bureau

The salaries of Foresters, Assistant Foresters, Inspectors, and Assistant Inspectors range from \$1,200 to \$2,400 per year. Actual and necessary traveling expenses to and from the scene of field work are allowed, and while in the field one dollar gold per day is allowed for subsistence.

There are a number of vacancies in the different grades, and good men are urgently needed for this interesting and important work.


The work of the Foresters is, to a large extent, technical; that of the Inspectors more administrative and less technical.

Examinations will be held in different parts of the United States about July 1 and November 1. For detailed information apply to the Bureau of Forestry, Washington, D. C., or to the Bureau of Insular Affairs, War Department, Washington, D. C.

Foresters and Inspectors now in the Philippine forest service and having from two to three and a half years' service, find the work very attractive, instructive, and healthful.

Copies of the Philippine Civil Service Manual may be obtained from the Bureau of Insular Affairs, War Department, Washington, D. C.

The reports, bulletins, and other publications of the Philippine Forestry Bureau should be read by all desiring to enter the service. Copies may be obtained by addressing the Forestry Bureau, Manila, P. I.



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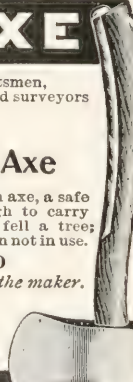
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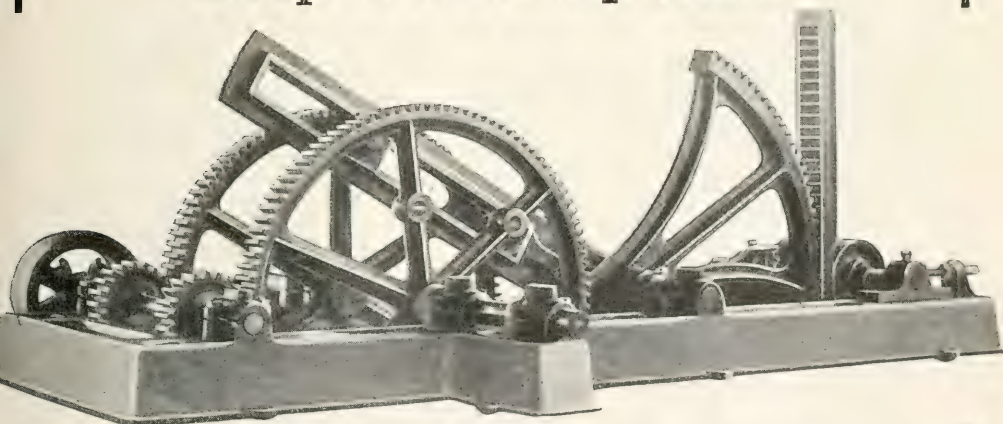
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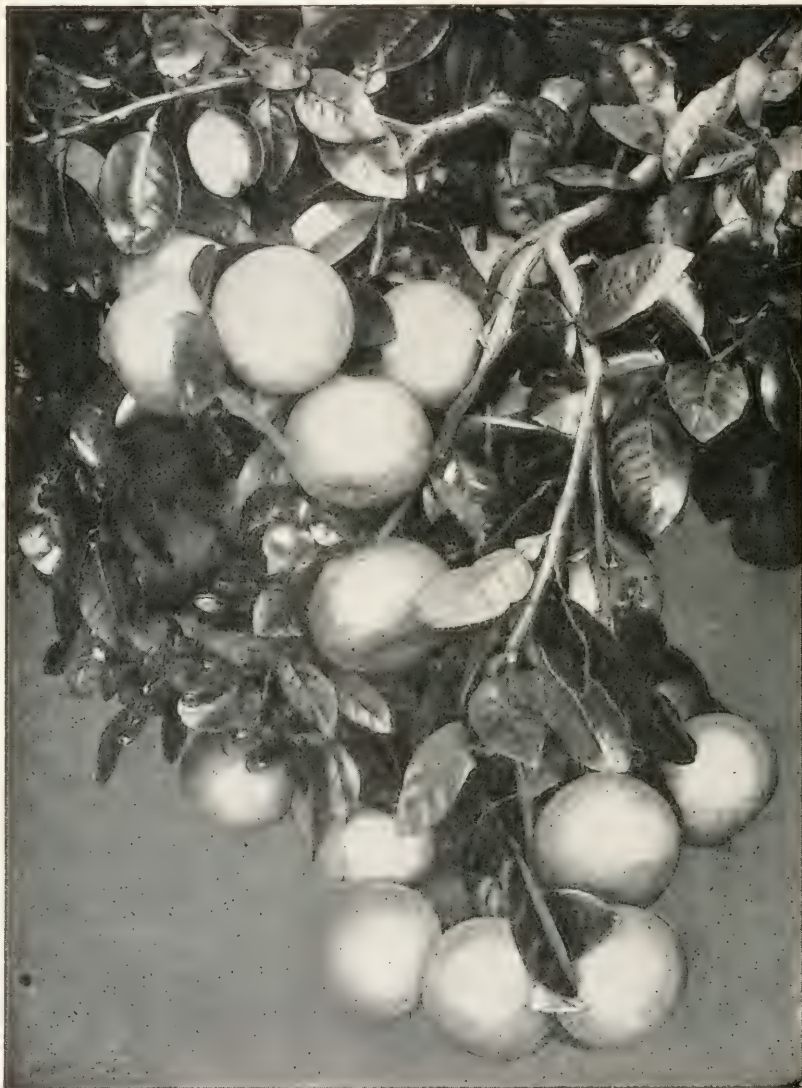
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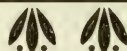
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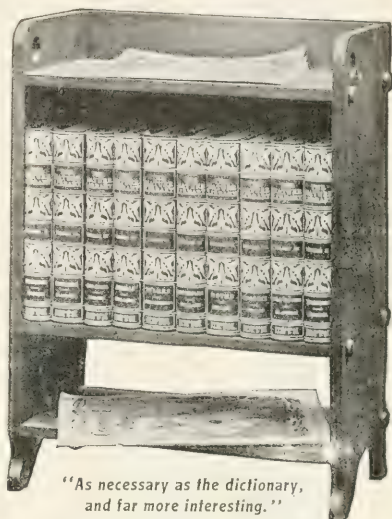
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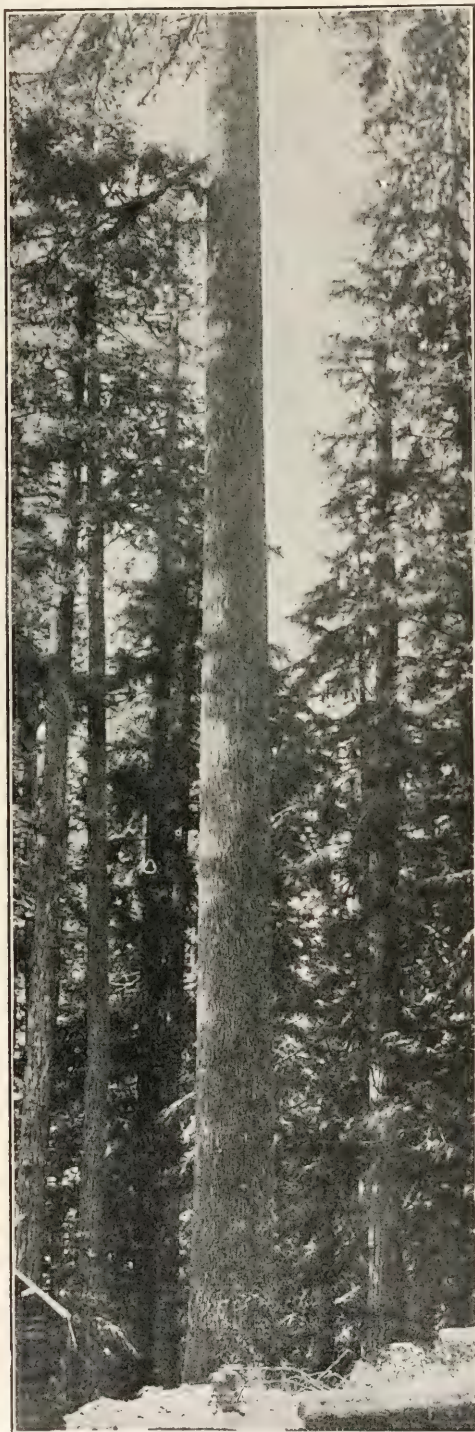


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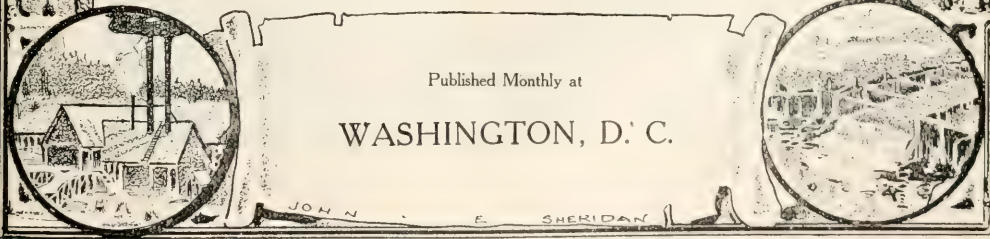
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JOHN E. SHERIDAN





Scene in the Teton Forest Reserve, Wyoming.

Forestry and Irrigation.

VOL. X.

NOVEMBER, 1904.

NO. II.

AMERICAN FOREST CONGRESS Washington, D. C.

JANUARY 2, 3, 4, 5, 6, 1905.

OFFICIAL CALL.

An American Forest Congress under the auspices of the American Forestry Association will meet in Washington, D. C., January second to sixth, 1905.

The purpose of this Congress is to establish a broader understanding of the forest in its relation to the great industries depending upon it; to advance the conservative use of forest resources for both the present and the future need of these industries; to stimulate and unite all efforts to perpetuate the forest as a permanent resource of the Nation.

All who are interested in securing these ends are urged to attend this Congress.

The fact that the President of the United States will address the Congress and receive its members is significant of its national importance, while the promised attendance of many of the foremost men of our industrial life assures definite and far-reaching results from its deliberations.

The Congress will include :

Members of the United States Senate and House of Representatives.

Ambassadors, Ministers, and other representatives of foreign nations.

Governors of States and Territories.

Members of the Society of American Foresters.

Faculties of Forest Schools.

State Forest officials.

Professional foresters in private work.

100 Delegates from the American Forestry Association.

Editors of Lumber and other Trade Journals of industries dependent upon the forest.

25 Delegates from the Bureau of Forestry of the U. S., Department of Agriculture.

25 Delegates from the United States Geological Survey.

50 Delegates from the United States General Land Office and Forest Reserve Service.

75 Delegates from the National Irrigation Association.

75 Delegates from the National Irrigation Congress.

5 Delegates from each Forestry Association, State or local.

10 Delegates from the Canadian Forestry Association.

- 5 Delegates from the Canadian Forest Service.
- 5 Delegates appointed by the Governor of each State and Territory.
- 5 Delegates from each Lumberman's Association.
- 5 Delegates from each Wood-working Association.
- 5 Delegates from each Mining Association.
- 5 Delegates from each Stockmen's Association.
- 5 Delegates from each Turpentine Association.
- 2 Delegates from each Railroad, Telegraph, or Telephone Company.
- 15 Delegates from the American Society of Civil Engineers.
- 15 Delegates from the American Institute of Mining Engineers.
- Chiefs of Bureaus and Divisions of the United States Department of Agriculture.
- 2 Delegates from each Chamber of Commerce and Board of Trade.
- Delegates-at-large appointed by the President of the Congress from forest landowners and those who have rendered distinguished service to the cause of American Forestry.

On Monday at 12 o'clock noon, January 2, the delegates will be received in a body at the President's New Year's reception at the White House.

Morning and afternoon sessions will be held on January 3, 4, 5, and 6. A subject of wide industrial importance will be discussed at each session by men whose experience and standing qualify them to speak authoritatively upon it.

The subjects, each of which will receive attention at a separate session, are :

1. Relation of the Public Forest Lands to Irrigation.
2. Relation of the Public Forest Lands to Grazing.
3. The Lumber Industry and the Forest.
4. Importance of the Public Forest Lands to Mining.
5. Forestry in relation to Railroad Supplies.
6. National Forest Policy.
7. State Forest Policy.

The sessions of the Congress will be held in the National Rifles Armory, 920 G Street, northwest, which has a seating capacity of eight hundred. All meetings at this hall will be open to the public. On the afternoon of January 5 a special meeting will be held in the Lafayette Theatre, which will be addressed by the President of the United States and other men prominent in our industrial and National life. Admission to this meeting will be by ticket.

A rate of one and one-third fare for the round trip, on the certificate plan, has been granted by nearly all railroads in the United States and Canada in case one hundred persons attend the Congress. In order to secure this rate delegates must procure certificates at starting points.

The headquarters of the Congress will be maintained at the National Rifles Armory for the registration of the delegates, the issuance of membership certificates, and the general information and convenience of those in attendance.

The co-operation of all newspapers and other publications is requested in giving wide publicity to this Official Call and in directing attention to the national importance of this Congress.

THE AMERICAN FORESTRY ASSOCIATION,

JAMES WILSON, *President*.

ORGANIZATION OF THE CONGRESS

Honorary President,

THE PRESIDENT OF THE UNITED STATES.

President of the Congress,

HON. JAMES WILSON.

Committee of Arrangements.

James Wilson,
Secretary of Agriculture.

A. J. Cassatt,
President, Pennsylvania Railroad.

Howard Elliott,
President, Northern Pacific R'y.

John Hays Hammond,
Mining Engineer.

T. J. Grier,
Superintendent, Homestake Mining Co., Lead,
South Dakota.

Fred Weyerhaeuser,
St. Paul, Minn.

N. W. McLeod,
President, National Lumber Manuf'rs Ass'n.

V. H. Beckman,
Editor, PACIFIC LUMBER TRADE JOURNAL.

R. A. Long,
President, Southern Lumber Manuf'rs Ass'n.

George K. Smith,
Secretary, National Lumber Manuf'rs Ass'n.

Garret Schenck,
President, Great Northern Paper Co.

Thomas Walsh,
President, National Irrigation Association.

H. B. F. Macfarland,
President, Board of District Commissioners.

W. S. Harvey,
President, Board of Trustees Phila. Commercial
Museum.

John Joy Edson,
President, Washington Loan & Trust Co.

Dr. Albert Shaw,
Editor, REVIEW OF REVIEWS.

Whitelaw Reid,
Publisher, NEW YORK TRIBUNE.

Charles D. Walcott,
Director, U. S. Geological Survey

F. H. Newell,
Chief Engineer, U. S. Reclamation Service.

George H. Maxwell,
Executive Chairman, The National Irrigation
Association.

B. L. Wiggins,
Vice-Chancellor, University of the South.

George P. Whittlesey,
Director, American Forestry Association.

Overton W. Price,
Associate Forester, Bureau of Forestry.

Redfield Proctor,
United States Senator from Vermont.

Henry C. Hansbrough,
United States Senator from North Dakota.

Nathan B. Scott,
United States Senator from West Virginia.

Thomas R. Bard,
United States Senator from California.

James W. Wadsworth,
Member of Congress from New York.

John F. Lacey,
Member of Congress from Iowa.

Frank W. Mondell,
Member of Congress from Wyoming.

F. J. Hagenbarth,
President, National Live Stock Association.

Jesse Smith,
President, Utah Wool Growers' Association.

H. A. Jastro,
General Superintendent, Kern County Land
Co., California.

E. S. Gosney,
Manager, Gosney & Perkins Bank, Flagstaff,
Arizona.

W. A. Richards,
Commissioner, General Land Office.

B. T. Galloway,
Chief, Bureau of Plant Industry.

Gifford Pinchot,
Forester, U. S. Department of Agriculture.

H. S. Graves,
Director, Yale Forest School.

Filibert Roth,
Director, Forestry Department University of
Michigan.

F. V. Coville,
Botanist, U. S. Department of Agriculture.

Wm. L. Hall,
Assistant Forester, Bureau of Forestry.

James B. Adams,
In charge of Records, Bureau of Forestry.

Hermann von Schrenk,
In charge of Forest Products, Bureau of Forestry

H. M. Suter,
Editor, FORESTRY AND IRRIGATION.

C. J. Blanchard,
Statistician, U. S. Reclamation Service.

Subjects to be Considered.

1. Relation of the Public Forest Lands to Irrigation.
2. Relation of the Public Forest Lands to Grazing.
3. The Lumber Industry and the Forest.
4. Importance of the Public Forest Lands to Mining.
5. Forestry in Relation to Railroad Supplies.
6. National Forest Policy.
7. State Forest Policy.

NEWS AND NOTES.

Interest in
the Congress

The general interest fested in the American Forest Congress, to be held in Washington, D. C., January 2 to 6, as announced in both the October and the present issues of FORESTRY AND IRRIGATION, is especially gratifying to those in charge of the arrangements. Prominent men throughout the country have signified their intention of being present and participating in the deliberations of the Congress, and the committee is particularly encouraged by the commendatory tone of the letters received, as evidencing sincere and widespread interest in forestry and recognition of its importance to the country. The time set for the congress is an especially favorable one in that it permits the attendance of the recognized authorities in forestry and its kindred subject, irrigation, who are employed in the Bureau of Forestry and the United States Reclamation Service. The field season for each of these branches of the government service do not end until late in the year, and the presence in Washington of those who have had actual experience and training in forestry and irrigation should lend particular interest to proceedings of the congress. Mr. F. H. Newell, Chief Engineer of the Reclamation Service, and Mr. Charles D. Walcott, Director of the U. S. Geological Survey, will be present and enter actively into the work of the congress, and Hon. Jas. Wilson, Secretary of Agriculture and President of the American Forestry Association, under the auspices of which the congress is held, will act as presiding officer during its several sessions.

Arrangements are now in progress to secure the attendance of students in forest courses at the various colleges throughout the country, and it is probable that the entire classes at the Yale Forest School, the Biltmore Forest School, and probably those in

the forestry department of the University of Michigan will attend.

As announced in the official call on another page of this issue, President Roosevelt will deliver the principal address at one of the sessions. The interest of prominent men in the West is especially worthy of mention. Governor Pardee of California though detained in his State at the time of the congress, owing to the sessions of the State Legislature, has written to state his unqualified approval of the objects of the convention, and his sincere interest in practical forestry. E. S. Gosney, one of the foremost grazing experts of the Southwest, will come as a delegate from Arizona; Mr. F. J. Hagenbarth, president of the National Live Stock Association, will attend, as will Mr. Howard Elliott, President of the Northern Pacific Railroad; Senator Thomas R. Bard, of California; Mr. N. M. McLeod; H. A. Jastro, General Superintendent of the Kern County Land Company, of California; and Mr. Victor H. Beckman, Editor of the *Pacific Lumber Trade Journal*.

Among the other prominent men who will be present are: John Hays Hammond; Colonel W. S. Harvey, Vice President of the Pennsylvania Forestry Association; Mr. John Joy Edson; Representative Lamb of Virginia; Senator F. M. Simmons; Hon. H. B. F. Macfarland, President Board of Commissioners, District of Columbia; Baron Speck von Sternburg German Ambassador to the United States; Commissioner Richards, of the General Land Office; Senator Redfield Proctor of Vermont; Mr. Garrett Schenck, President of the Great Northern Paper Company; Senator Scott of West Virginia; Mr. George K. Smith, Secretary of the National Lumber Manufacturers' Association; Mr. Thomas F. Walsh, President of the National Irrigation Association; Dr. B. L. Wiggins, Vice-chancellor the University of the South; Dr. Albert

Shaw, editor of "*The Review of Reviews*," Hon. Whitelaw Reid, and many others.

Indications point to an attendance of 1,000 delegates, and the congress should mark the beginning of an era of a more thorough interest and appreciation in practical forestry.

Yale Forest School

This year for the first time the Junior Class of the Yale Forest School came together in July at Milford, Penn. Usually the Juniors have met in New Haven in September. The purpose of adding a summer term to the Junior year is to give an opportunity for a greater amount of field work in forest mensuration and silviculture than was possible under the previous conditions. The summer term opened July 1 and continued until September 10. The experiment was an unqualified success and fully met the anticipations of the officers of the school. Prof. H. S. Graves conducted the work, assisted by Mr. E. E. Carter, now Instructor in Forestry in Harvard University. The addition of a summer term to the course at Yale is one of the most important steps taken since the establishment of the school, not only because the efficiency of the courses in forest mensuration and silviculture have been emphatically increased, but also because the change has permitted the addition of several new courses and the rearrangement of the old courses. The most important new courses are forest engineering by Assistant Prof. R. L. Marston, and Physiography by Prof. H. E. Gregory. Some further important changes will be announced in the new catalogue which will be issued in a few weeks.

The equipment of the Forest School at Milford, Penn., has been very much extended during the past season. A new lecture hall and a permanent dining hall and kitchen have been erected through the generosity of Mr. James W. Pinchot and his family; and the number of tents has been increased

to nearly fifty. The school now has at Milford a very thorough equipment for the summer work.

The Summer School of the University, which has been conducted at Milford since 1901, held an extremely successful session this year. The students live in camp with the Juniors of the regular department, but the instruction is entirely separate. The work was conducted by Prof. J. W. Toumey, assisted by Mr. A. H. Graves, Instructor in the Yale Forest School. Sixteen students were in attendance.

The total registration at the Yale Forest School this fall is sixty-three, or one less than last year at this time.

Biltmore Forest School

The new courses offered by this school during the year 1904-1905 comprise a course in denrology, a course in forest entomology, a course in forest pathology, a course in forest zoology, a course in irrigation and its interdependence with forestry, a course on the forest work conducted by the Federal Government. All of these courses are to be given by specialists in the employ of the United States Government at Washington.

The attendance at the school at the present time is fifteen. Mr. Clifton D. Howe has been appointed assistant forester and instructor in botany. The Biltmore saw mills will work on Avery's Creek during the year. The cutting of tannin wood, of tanbark and of wood for the Asheville market will be conducted in the present year as during the past. A shingle plant will be added to the equipment of the wood splitting mill at Biltmore.

The nurseries have been increased during the last year and are now stocked with several million pines (white and yellow) and several hundred thousand hardwoods. The stock raised in these nurseries will be largely used for the reforestation on the Bent Creek Estate, near Biltmore, comprising 15,000 acres.

Michigan Agricultural College

At the Michigan Agricultural College fifteen young men have entered with the expectation of completing the forestry course. Of these seven are from Michigan, four from New York, and each of the following named states are represented by one student: Ohio, Indiana, Mississippi, and California. Twenty-three men in the freshman year of the five-year agricultural course are receiving instruction in the elements of the subject. All the work in the junior and senior years will be given this year with little modification of last year's programme. The two men who graduated from this course last June have been employed during the summer by the State Forestry Commission. Regular meetings of the organization known as the M. A. C. Foresters will be held during the year. This organization is composed of the students in the forestry course and others especially interested in the subject. The meetings are held each alternate week and the discussions are led by some advanced student or by a special lecturer. The officers are Chief Forester, Chief or Records Account, Forest Ranger, Executive and Programme Committees.

University of Maine

The undergraduate course in forestry at the University of Maine had, during the college year of 1903-4, an enrollment of forty-five students who elected courses in forestry. Of this number four made this subject their major course, with a view of taking it up as a profession. At the opening of the present college year the number of students who have chosen forestry as a profession has been increased to ten.

In Iowa

For some years the professor in charge of the Department of Horticulture and Forestry at the Iowa State College of Agriculture and Mechanics Arts has given an elementary

course in Forestry, but this past year the college decided to enlarge the work by introducing several courses bearing especially upon farm forestry. Mr. H. P. Baker, of the Bureau of Forestry, was elected as Assistant Professor in charge of Forestry and Forest to the Experiment Station, and assumed control of the work on September 1. Half of his time will be given to the College work and the other half to studying Iowa forest conditions for the Bureau of Forestry.

So far three courses have been established, which are as follows:

Course I. *Elementary Forestry*. This course will be a discussion in a brief way of Forestry and its objects, with the main portion of the course given to a study of trees and tree planting in Iowa, touching on the subject of wood, its structure, uses, and preservation. This work will be a four-hour study for the first semester of the sophomore year and will be eventually required of all agricultural students. This fall forty men are taking the course.

Course II. *Silviculture*. This is an elective course in the Junior year for those who have completed Course I. Nine men have taken up this work, which consists of three hours of lectures and three hours field work during the entire semester. In this course will be discussed the distribution and character of native forests and factors of tree growth and tree planting in Iowa; the management of the farm wood-lot and its protection from fire, etc., with a brief discussion of forest measurement, and timber and its uses.

Course III. *Forest management and Policy* will be an elective in the Senior year for those who have taken Courses I and II, and is designed for the men who wish to enter Forestry as a profession. This course will take up simple questions of forest management in their application to the farm grove or woodlot. Under forest policy will be discussed land policies, forest ownership, forest history, state and national forestry, and irrigation and forestry.

A fourth course is being prepared as an elective for Civil Engineer students, a number of whom have asked that such a course be given. This work will be a study of summer and winter characteristics of common trees, with a study of the structure and identification of woods found on the ordinary market.

The work will be broadened and strengthened by work in the Department of Entomology by Prof. H. E. Summers, and in the Department of Botany by Prof. L. H. Pammel, bearing directly upon the subject of Forestry.

Half of Professor Baker's time will be given to the work of the Experiment Station, which is just beginning a series of experiments in co-operation with the Bureau of Forestry in methods of treating soft wood fence posts, such as soft maple, willow, and cottonwood. From 800 to 1,000 posts have been donated by farmers of the state, and the results are being watched with a great deal of interest. The fence post problem is a big one in the state of Iowa, and immense numbers of posts are used annually by the farmers and stockmen at a large expense. Exhibition plots of the various trees adapted to Iowa conditions will be started next spring and various experiments in growing and handling tree seedlings will be carried on.

University of Michigan

Forest work at the University of Michigan continues under direction of Professor Roth, assisted by Professor Davis. Under Professor Roth's direction the courses in forestry at this institution made an excellent start, and with the larger result of arousing throughout the state a much needed sentiment in favor of forest preservation. The opening of the new collegiate year finds the attendance at Michigan increased over that of last.

A City Planting a Forest

Los Angeles, Cal., has 3,000 acres of brush land called Griffith Park, which it intends to convert into

a commercial forest. This will be the first instance of a city in the United States creating a forest. The practice is quite common in Europe, where the forest-parks have not only contributed to the pleasure of the people, but have been more than self-supporting through their timber output. Under its cooperative offer the Bureau of Forestry had last summer at Los Angeles four of its experts, making a comprehensive planting plan for the forest. This plan was completed at the end of September. The idea is to convert a waste piece of land into a productive forest, which will not only pay for its creation and care through the sale of mature timber, but will prove a constant source of pleasure and recreation for the citizens of Los Angeles. It is an entirely practical plan, and Los Angeles deserves credit for its progressive spirit. Other cities could very profitably follow this excellent example.

An Example in Forestry

The Pocono Manor Association of Pennsylvania has 700 acres, covered principally with a dense growth of chestnut and chestnut oak sprouts, which it intends to improve by forestry. This Association has spent a large sum of money in erecting buildings and improving the conditions of its grounds for the comfort and pleasure of its members during the summer months. The tract of land is on Little Pocono Mountain, about 20 miles north of Delaware Water Gap, and is at present in a very bad condition. It was lumbered some forty years ago, and has been burnt over periodically about once every four or five years since then. Its present tree growth is only brush from 6 to 10 feet high—and not always that. Thinning must be done, and also some planting in the bare places.

The greatest need is protection from fires. At the Association's solicitation, the Bureau of Forestry, early in 1903, made plans for the improvement and protection of the 700 acres. These plans are now being put in opera-

tion. Their special significance will be in showing what can be done by forestry where ax and fire have done their worst in impoverishment of both soil and timber. As very much of the country, not only in that part of the State, but in many other regions of the East, shows the effects of the same evils, the reclamation of this tract of land will offer a splendid object lesson, and should be encouragement for work of the same kind elsewhere.

Timber Seasoning Stations

The Bureau of Forestry has recently signed an agreement to make extensive timber seasoning tests in two Western States, in cooperation with two telegraph and telephone companies. Experimental stations will be located at Marinette, Wis., and Escanaba, Mich.; and probably a third station will be established at Ashland, Wis. The expense of the experiments will be borne jointly by the Bureau and the companies. Cedar and tamarack telephone and telegraph poles will be furnished by the State of Wisconsin free of cost, and two railroad companies have agreed to haul them to the experiment stations without charge for freight.

The object of the experiments is to determine how many years can be added to the life of each pole by proper seasoning. Since millions upon millions of poles are used along telegraph and telephone lines, even one year's extra service for each pole will amount to a tremendous saving in expense. Unseasoned cedar poles last from twelve to fifteen years. Seasoning experiments have shown how to increase this time by three or four years, and it is now expected to improve on this increase. Past methods of seasoning have effected a drying out of 20 per cent of the original weight of the poles.

Report of Reclamation Service

The Second Annual Report of the Reclamation Service, which was compiled under the supervision of Mr. F. H. Newell, chief engineer, is

now available. It is a continuation of the First Annual Report, which was completed on November 29, 1902, and transmitted at the opening of the second session of the Fifty-seventh Congress. The statements made in the first report are supplemented in the second by an account of the results accomplished during the field season of 1903 by Mr. Newell and his assistants.

The present report opens with a discussion of the reclamation law and the application of its various provisions under existing conditions. In transmitting the report to the Secretary of the Interior, the Director of the United States Geological Survey states that a practical application of the provisions of the law has shown them to be effective, and that so far as can be seen, at the present time, no further legislation is required, as the law seems to have sufficient scope to accomplish its purpose. Following the exposition of the law comes a statement of decisions made by the Secretary of the Interior relating to the Reclamation Service. These refer to withdrawal of lands, limitation of the areas of homestead entries, the establishment of water rights, the purchase of lands, the reservation of rights of way, supervision over right of way applications, the ordering of public-land surveys, etc. The various State and local agencies organized to assist in carrying out the reclamation law are also briefly described.

The bulk of the report consists of detailed descriptions, arranged in alphabetical order, by States and Territories, of the operations in the field. These descriptions are by the district engineers in charge of the operations. Mr. Arthur P. Davis writes of the investigations made in Arizona and New Mexico; Mr. J. B. Lippincott, of the work in California; Mr. A. L. Fellows, of the investigations in Colorado; Mr. D. W. Ross, of those in Idaho; Mr. W. G. Russell, of those in Kansas; Mr.

Cyrus C. Babb, of the investigations in Montana; Mr. L. H. Taylor, of the work in Nevada; Mr. F. E. Weymouth, of the work in North Dakota; Mr. Ferdinand Bonstedt, of the investigations in Oklahoma; Mr. John T. Whistler, of those in Oregon; Mr. C. H. Fitch, of those in South Dakota; Mr. G. Svendsen, of the work in Utah; Mr. T. A. Noble, of the investigations in Washington; and Mr. John E. Field and Mr. Jeremiah Ahern, of the investigations in Wyoming.

Within the year actual construction was begun in Nevada on a large canal from Truckee River. In Arizona preliminary construction was commenced on the Salt River dam, which will furnish water to arid lands in the vicinity of Phoenix. In other States and Territories plans and specifications are in various stages of progress. Everywhere the work is being pushed as rapidly as is consistent with a full knowledge of conditions and with economical administration.

Awakening in Illinois.

Readers of FORESTRY AND IRRIGATION will be interested in learning the action taken upon forest matters by the Illinois Federation of Women's Clubs at the State meeting held at Danville October 18-21. This meeting was largely attended, and was one of the most successful in the history of the Federation. The forestry subjects on the programme were: "What Forestry Means to Illinois Through the Work of the Forestry Committee of the Federation," by Mrs. P. S. Peterson, of Chicago; "Forest Life—Habitat and Sojourner," by Mrs. E. C. Lambert, of Jacksonville; "A Forest Policy for Illinois," by R. S. Kellogg, of Bureau of Forestry.

The Federation also indorsed bills for the establishment of a Department of Forestry at the State University and the creation of a State Forest Reserve. There is good reason to think that action of some kind along forestry lines will be secured at the next session of the Legislature.

Forest Nursery in Minnesota.

Regarding the spruce and pine nursery on the Pillsbury forest reserve sixteen miles north-west of Brainerd, which has just been inspected by General Andrews and Professor Green, both of the executive committee of the Minnesota State Forestry Board, the former reports that:

The nursery is a carefully cultivated and fenced acre, in which principally Norway spruce seeds were sown in long beds last spring. The Norway spruce came up fairly well. In many of the beds the rows are full of thrifty plants. The white pine and white spruce did not come up as well. The trees vary from an inch to three inches in height and we estimated that there are about a million of them.

The sight of so many young trees perfectly free from weeds was most pleasing. Half the nursery is covered with lath screens and the other half with brush screens on poles resting on firmly-set posts eight feet high. This shade has tinged the whole floor of the nursery with green moss—an interesting picture. The screens were planned by Professor Green, and were made by Lars Hope, the nursery keeper, in workman-like manner, and will last several years.

The nursery being half a mile from Mr. Hope's residence, he was unable to prevent some of the seeds after they were sown from being consumed by blackbirds and gophers. To dispatch the rest, Mr. Hope put into their holes paper saturated with bisulphide of carbon. To the blackbirds he issued a few rations of millet mixed with Paris green with desired effect.

Before snow falls these seedlings will receive a thin cover of hay. Before they are over two years old they should be taken up and set where they are to remain permanently. It is believed that spruce for pulp will yield quicker returns than any other tree on cut-over lands or light soil, and probably the Minnesota Forestry Board will experiment in growing spruce on a part of the Pillsbury land if the next legislature will furnish means for doing so.

Irrigation Engineers Wanted.

The United States Civil Service Commission announces an examination on November 22-23, 1904, at the places mentioned in the accompanying list, to secure eligibles from which to make certification to fill vacancies as they occur in the position of irrigation engineer in connection with the irrigation and drainage investigations in the Office of Experiment Stations, Department of Agriculture. The initial salary will be from \$1,500 to \$2,000 per annum, according to qualifications.

The examination will consist of the subjects mentioned below, weighted as indicated:

Two days will be required for this examination, and the age limit is 20 years or over.

This examination is open to all citizens of the United States who comply with the requirements.

Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., for application Form 1312. No application will be accepted unless properly executed and filed with the Commission at Washington. In applying for this examination the exact title as given at the head of this announcement should be used in the application.

As examination papers are shipped direct from the Commission to the place of examination, it is necessary that applications be received in ample time to arrange for the examination desired at the place indicated by the applicant. The Commission will, therefore, arrange to examine any applicant whose application is received in time to permit the shipment of the necessary papers.

Laws Against Water Pollution.

A review of the laws forbidding the pollution of inland waters in the United States, which may be of great practical benefit to the public, has been prepared by Mr. Edwin

B. Goodell for the United States Geological Survey.

Mr. Goodell's purpose has not been to prepare a complete work on water pollution for the use of members of the bench and bar, but rather to put into the hands of public officials, legislators, water companies, manufacturers, farmers, and others interested in the subject, a guide for their action, and to furnish references to the sources from which a more exhaustive knowledge of the subject may be obtained if required.

No attempt has been made to present a detailed statement of the entire law against water pollution as it exists independently of statutes, but the broad legal principles under which anti-pollution statutes become operative are explained, and important court decisions are quoted to show authority for various deductions. These principles and decisions have been classified and are presented in three groups:

(1) The rights of riparian owners to pure water as against one another.

(2) The rights of the public (as distinguished from individual owners) to have inland waters kept free from pollution by riparian owners or others.

(3) The conditions under which, and the extent to which, public municipalities may use inland waters in the disposal of sewage matter from public sewers.

The statutes enacted in various States are classified according to their general scope and an opportunity is thus afforded to compare their effectiveness and desirability. In some States there is nothing more than a simple provision making it a crime to poison wells and springs, while in others elaborate provisions have been made to check and, so far as possible, absolutely prevent all pollution of all waters by the refuse products of animal life or the waste of human industry. In citing the statutes, Mr. Goodell has grouped the States together logically to show the stage of growth in sanitary education at which each has arrived.



MR. JAMES W. PINCHOT,

AMONG THE FIRST TO ADVOCATE THE INTRODUCTION OF FORESTRY IN THE UNITED STATES AND ONE OF THE FOUNDERS OF THE YALE FOREST SCHOOL.

ONE of the earliest advocates of the conservative handling of the forests of the United States, and a man whose services to the cause of forestry have grown with each succeeding year, is Mr. James W. Pinchot. His interest in the forest has been life-long as he was born in northeastern Pennsylvania in the palmy days of the lumber trade in that section, and much of his early life was spent in the woods. Mr. Pinchot many years ago perceived the necessity of doing something to preserve our rapidly disappearing forests, though, like many others since, just what should be done was not readily apparent. During a visit to France he first saw forestry practiced and was at once struck by the value and necessity of introducing similar methods in America. He advised his son, Mr. Gifford Pinchot, to make forestry his profession, a suggestion that was followed with the result that to-day the latter is Forester of the United States Department of Agriculture, and the recognized leader of the forest movement in this country.

Mr. Pinchot was born in 1831, went to New York in 1850 and went into business. He soon became the intimate personal friend of artists like Sanford, Gifford, McEntee, Whittredge, Kensett, Church, Eastman Johnson, Weir, and others.

He was one of the early members of the Century Club, and one of the early subscribers to the Metropolitan Museum. He was also a member of the Chamber of Commerce for many years and the first treasurer and a member of the Executive Committee of the American Committee for the Statute of Liberty. With other members of his family, he founded the Yale Forest School in 1900 and immediately after the Yale Summer School of Forestry. Later, with the officers of the school, he established the Milford Forest Experiment Station. Both for the Summer School and for the Experiment Station he has given land and buildings, and another large building is now in course of erection.

A COMPREHENSIVE FOREST LAW

Drawn for State of California by the Bureau of Forestry;
Contains Principles that Can be Applied in Other States.

The Bureau of Forestry has been cooperating with the State of California for two years past in order to determine on a sound state forest policy. The result of this work is now condensed into a forest bill to be considered by the California Legislature at its next session. This bill contains an outline of principles which the Bureau feels might properly form the basis for a general forest law for other states, modified, of course, to meet peculiar local conditions. It is based not only on the study in California, but also in the Bureau's experience in its work to date, throughout the country.

Owing to the wide interest in forest matters, especially in working for proper forest legislation, and the difficulties in securing it, it is felt that the publication of this proposed California forest law will be of value to readers of *FORESTRY AND IRRIGATION*. For that reason it is given in full elsewhere.

An act to provide for the protection and management of forest land within the State of California.

Sec. 1. *State Board of Forestry*.—There shall be a State Board of Forestry, consisting of the Governor, Secretary of State, Attorney General, Secretary of Agriculture, and State Forester, which shall supervise all matters of State Forest policy and management and convene upon call of the Governor or of its Secretary.

Sec. 2. *State Forester and His Duties*.—There shall be a State Forester, who shall be a technically trained forester, appointed by the Governor; and whether any candidate for this position is a technically trained forester shall be determined by certificate from the Forester of the United

States Department of Agriculture. He shall receive a salary of \$2,500 per year, or as much additional as shall, from time to time be allowed by the legislature for good and continued service; be supplied with necessary office room, equipment, clerical and field assistants; be reimbursed for all traveling and field expenses incurred in the conduct of his official business; act as Secretary of the State Board of Forestry; and be removed from office only for cause shown. He shall, under the supervision of the State Board of Forestry, execute all matters pertaining to forestry within the jurisdiction of the State; direct the management of State parks and forests; collect data relative to forest fires; prevent and extinguish forest, brush and grass fires; enforce all laws pertaining to forest or brush covered land, and commence prosecutions for violation of such laws; cooperate with land owners as described in section 4 of this act; supervise such courses in forestry at educational institutions as may hereafter be provided for by law; and publish from time to time such information on forestry as he may deem wise. He shall prepare annually a report to the Governor on the progress and condition of State forest work and recommend therein plans for improving the State system of forest protection, management, and taxation.

Sec. 3. *Supervision and Care of State Parks*.—The Yosemite Valley State Park, the Big Basin Redwood Park, the Mount Hamilton Tract, the Santa Monica Forest Station, and the Chico Forest Station, together with all money heretofore or hereafter appropriated for the purchase of land for or care of said parks, tracts and stations, shall be in charge of the State Board of Forestry, and said Board shall forthwith have all the powers and

duties now possessed in accordance with law by persons or commissions with regard to the State parks, tracts of land and forest stations mentioned in this act, and also of any forest land which may hereafter become permanent State property, or be placed definitely in the care of the State, and it is hereby enacted that, if the Governments of the United States shall, at any time, donate or entrust to the State of California for State park or State forest reserve purposes any tract or tracts of wholly or partially wooded land, such tract or tracts of land shall be administered at the expenses of the State, as provided by law for the State parks now in existence, or hereafter created.

Sec. 4. *Cooperative Work.*—The State Forester shall, upon request and whenever he deems it necessary to the best interests of the people and the State, cooperate with counties, towns, corporations, and individuals to devise plans for the protection and management of trees, wood lots, and timber tracts, on consideration and under an agreement that the parties obtaining such cooperation pay at least the field expenses of experts employed in preparing said plans.

Sec. 5. *Publication of Laws and Notices.*—The State Forester shall prepare and print for public distribution an abstract of all State forest laws, together with such rules and regulations in accord therewith as he may deem necessary, and shall annually print and distribute a list of all Fire Wardens, with their addresses. He shall also furnish notices, printed in large letters on linen, calling attention to the danger from forest fires and to forest fire and trespass laws and their penalties. Such notices shall be posted by the Fire Wardens in conspicuous places along every highway in brush or forest covered country, at frequent intervals along streams and lakes frequented by tourists, hunters and fishermen, at established camping sites, and in every post office in the forested region.

Sec. 6. *Assistant State Forester.*—There shall be an Assistant State For-

ester, who shall be a technically trained forester, appointed by the State Forester, with the approval of the State Board of Forestry. He shall receive a salary of \$1,500 per year and all traveling and field expenses incurred in the conduct of his official business. He shall perform such duties as may be assigned to him by the State Forester, whose place he shall fill during any disability or absence of the State Forester.

Sec. 7. *Chief and Assistant Chief and District Fire Wardens.*—The State Forester shall be Chief Fire Warden, and the Assistant State Forester shall be Assistant Chief Fire Warden. The Chief Fire Warden shall have charge of the District Fire Wardens, and all the Fire Wardens of the State, and aid and direct them in their duties. There shall be District Fire Wardens at salaries of \$1,000 each per annum and necessary traveling and field expenses, salaries and expenses to be paid half by the State and half by the counties composing the districts. Their expenses, when approved by the State Forester, and their salaries, when due, shall be audited and paid directly by the State, the amounts due from the several counties to be paid into the State treasury upon demand; such amounts to be apportioned among the counties composing the respective districts pro rata according to the assessed valuation of the real estate in such counties. They shall be appointed by the State Forester, with the approval of the State Board of Forestry for each of ten districts, the boundaries of which are to be determined from time to time by the State Forester, with the approval of the State Board of Forestry; and, furthermore, any county or combination of less than four counties shall be made a separate fire district upon request of the County Board or Boards of Supervisors, in which case such special fire district shall pay two-thirds and the State one-third of the cost of maintaining its District Fire Warden.

Sec. 8. *Duties of District Fire Wardens.*—The duties of District Fire

Wardens shall be to devote their entire time to State forest interests, according to rules and directions to be determined by the State Forester, with approval of the State Board of Forestry. They shall take prompt measures to prevent and extinguish forest fires, keep a record of the cause, extent, and damage of all forest fires in their respective districts, and perform such other duties as the State Forester may direct.

Sec. 9. *Voluntary Fire Wardens and Their Duties.*—Each District Fire Warden shall appoint, subject to the approval of the State Forester, in such number and localities as he deems wise, public-spirited citizens to act as Voluntary Fire Wardens. They shall promptly report all fires to the respective District Fire Wardens and take immediate and active steps towards their extinguishment, report any violation of the forest laws, and assist in apprehending and convicting offenders, and give all possible assistance to the District Fire Wardens. For such services payment shall be made by the State at the rate of 25 cents per hour for the time actually employed, provided that payment for such services shall not be made to any Federal forest reserve officials, who act as Fire Wardens, and shall not in any case exceed \$50 for one year. The Supervisors and Rangers on the Federal forest reserves within the State, whenever they formally accept the duties and responsibilities of Fire Wardens, shall be appointed as Voluntary Fire Wardens, and shall have all the powers given to Fire Wardens by this act.

Sec. 10. *Powers and Requirements of Fire Wardens.*—All Fire Wardens shall have the powers of peace officers to make arrests, without warrant, for violations of any State or Federal forest laws. Any Fire Warden who has information which would show, with reasonable certainty, that any person had violated any provision of such forest laws, shall immediately take action against the offender, either by using his own powers as a peace officer, or by making complaint before the proper

magistrate or by information to the District Attorney, and shall obtain all possible evidence pertaining thereto.

Sec. 11. *Assistance and Compensation of Citizens in Fighting Fires.*—All Fire Wardens shall have authority to call upon able-bodied citizens, between the ages of 16 and 50 years, in the territory in which they act, for assistance in putting out fire, and any such persons who refuse to obey such summons, unless prevented by good and sufficient reasons, shall be liable to a fine of \$15, to be collected in action for debt by State prosecution to be made by the Fire Warden who issued the summons. Compensation for services rendered in fighting fire shall be at the rate of 20 cents per hour for the time actually employed, one-half to be paid by the State and one-half by the county in which fire occurred. The Fire Warden in charge shall submit time record and bill of the men employed to the District Fire Warden, who shall examine and forward it, immediately, to the State Forester, with approval or criticism. The State Forester, if he approves the bill, shall forward it at once to the State Auditor, who shall pay it in full, as soon as audited and found correct, one-half due from the county to be collected afterwards by the State. Fire Wardens shall assist, with the help of the citizens at their disposal, in extinguishing fires either wholly or partly in adjacent counties. In the case of fire fighting outside the county in which citizens reside, the summoning Fire Warden shall note the fact in his record and bill of the men employed and the State Auditor shall charge only one-third of the amount, due from the counties for any particular fire, to the county from which the men were summoned to the adjacent county, the other two-thirds being chargeable against the county in which the fighting was actually done. The District Fire Wardens shall have power to incur expense for the transportation and other expenses of fire fighters, and shall include the same, with necessary vouchers, in his account. Such expenses shall be paid

by the State Auditor and apportioned among the counties as provided for expenses earlier in this section.

Sec. 12. *Fire Patrol*.—In times and localities of particular fire danger, the State Forester shall maintain a fire patrol, through the District Fire Wardens, at such places in brush or forest land as the public interest may require, two-thirds of the expense of such patrol to be paid by the county and one-third by the State.

Sec. 13. *District Attorneys to Prosecute Vigorously*.—Whenever an arrest shall have been made for violation of any provision of this act, or whenever any information of such violation shall have been lodged with him, the District Attorney of the County in which the criminal act was committed must prosecute the offender or offenders with all diligence and energy. If any District Attorney shall fail to comply with the provisions of this section he shall be deemed guilty of a misdemeanor, and, upon conviction, shall be fined not less than \$100 nor more than \$1,000, or be imprisoned not less than thirty days nor more than one year, or both, in the discretion of the court. The penalties of this section shall apply to any magistrate, with proper authority, who refuses or neglects to cause the arrest and prosecution of any person or persons when complaint, under oath, of violation of any terms of this act has been lodged with him.

Sec. 14. *Destruction of Warning Notices*.—Any person who shall maliciously or thoughtlessly destroy, deface, remove or disfigure any sign, poster or warning notice posted under the provisions of this act shall be guilty of a misdemeanor and punishable upon conviction by a fine of not less than \$15 nor more than \$100, or imprisonment in the county jail for a period of not less than ten days nor more than three months, or both.

Sec. 15. *Wilfully, Maliciously or Negligently Setting Forest Fires*.—Every person who wilfully, maliciously or negligently sets on fire or causes or procures to be set on fire any woods, brush, prairies, grass, grain or stubble

on any lands not his own, or allows a fire to escape from his own land, whereby any property of another is injured or destroyed, or accidentally sets any such fire or allows it to escape from his control without extinguishing it, or using every effort to extinguish it, shall be deemed guilty of a misdemeanor, and upon conviction shall be fined not less than \$50 nor more than \$5,000, or imprisoned not less than thirty days nor more than five years, or both. Setting such fires or allowing them to escape shall be prima facie proof of wilfulness, malice or neglect under this section; provided, that nothing herein contained shall apply to a person who, in good faith, sets a back fire to check a fire already burning.

Sec. 16. *Civil Liability for Forest Fires*.—In addition to the penalties provided in sections 15, 17, 18 and 19 of this act, the United States, the State, the County, or private owners, whose property is injured or destroyed by such fires, may recover, in a civil action, double the amount of damages suffered; in case the fires were willful or malicious, or in case such fires were caused or escaped accidentally or unavoidably, civil action shall lie only for the actual damage sustained, as determined by the value of the property injured or destroyed and the detriment to the land and the vegetation thereon. The presumption of wilfulness, malice or neglect shall be overcome, provided the person leaving a fire, under section 17, uses reasonable precaution to extinguish it; or, under section 19, the precautions provided in that section are observed; or, under section 18, fires are set with permission of and under direction of the District Fire Warden, during the "dry season;" or, during the wet season, fires are not set until after one full day's notice is given to each and every adjacent land owner.

Sec. 17. *Extinguishment of Camp Fires*.—Every person who, upon departing from a camp or camping place, in brush or forest land, wilfully or negligently leaves fire burning or unextinguished, or who upon building

such fires does not take proper precautions to prevent its spread, whereby it might be communicated to brush or forest land and do damage, shall be subject to a fine of not less than \$50 nor more than \$250, with costs of suit and collection; and if the defendant or defendants refuse or neglect to pay the fine and costs imposed, or make satisfactory arrangement for the payment of same within thirty days, he or they shall be confined in the common jail of said county for a period not less than thirty nor more than sixty days.

Sec. 18. *Restrictions of Use of Fire in Dry Season.*—It shall be unlawful, during what is locally known as the "dry season (this to be considered as the period between May 15 and the first soaking rains of autumn), for any person or persons to burn brush, stumps, logs, fallen timber, fallows, brush, grass or forest covered land, grain, or stubble, or blast wood with dynamite, powder or other explosives, or set off fireworks of any kind in forest or brush-covered land, either their own or the property of another, without permission of and under the direction or supervision of the District Fire Wardens; these restrictions not to apply to the ordinary use of fire or blasts in logging redwood, nor in cases where back fires are set in good faith to stop an existing fire. Violations of these provisions shall be a misdemeanor, punishable upon conviction by a fine of not less than \$50 nor more than \$1,000, or imprisonment not less than thirty days nor more than one year, or both. Persons or corporations causing fires by violation of this section shall be liable to the State, in an action for debt, to the full amount of all expenses incurred in fighting such fires.

Sec. 19. *Engines in Forest Land.*—Logging locomotives, donkey or threshing engines, railway locomotives and all other engines, boilers and locomotives operated in, through or near forest, brush or grass land, which do not burn oil as fuel, shall be provided with netting or steel or iron wire so constructed as to give the best prac-

ticable protection against the escape of fire and sparks from the smokestacks thereof and adequate devices to prevent the escape of fire from ash pans and fire boxes; and failure to comply with these requirements shall be a misdemeanor, punishable upon conviction by a fine of \$500; and any officer or employe of a railroad company violating any provision of this section shall be liable to a penalty of \$100 for every such violation; and, furthermore, the railroad company or owner of such engines shall be liable in a civil suit for all damage to any property of any kind whatever injured or destroyed by fire caused by such engines, such damages to include detriment to the land and the vegetation thereon.

Sec. 20. *Criminal Action—Forest Trespass.*—Every person who unlawfully and wilfully cuts, injures or destroys any kind of wood or timber or the product of such wood or timber standing or growing upon the lands of another, or of the State or of the United States, or upon any public highway, or carries away any wood or timber or products thereof from such lands, is guilty of a misdemeanor, and, upon conviction, shall be fined not less than \$25 nor more than \$1,000, or be imprisoned not less than fifteen days nor more than three years, or both, in the discretion of the court.

Sec. 21. *Civil Liability for Forest Trespass.*—In addition to the penalties provided in section 20 for willful trespass on forest lands, the private owners, the United States, the State, or the County upon whose lands the willful trespass was committed may recover in a civil action double the amount of damages suffered; or, in case of involuntary or innocent trespass, or of taking such wood or timber from uncultivated woodland for the repair of a public highway or bridge upon or adjacent to the land, civil action shall lie only for the actual damage, as determined by the value of the wood and timber taken and the detriment to the land.

Sec. 22. *Clearing Along Country*

Roads and Railroads.—Counties, along the county roads, and railroad companies, along their lines of road, in forest or brush land, shall, when so directed by the State Forester, and in a manner and to an extent prescribed by it, cut and remove all brush, grass and inflammable material from their rights of way. If such clearing is not done within a reasonable time after notice, said time to be fixed by the State Forester, the State Forester shall have it done and the County or railroad company shall be liable in an action of debt for the expense thus incurred, and in addition thereto for the expense of any fire patrol rendered necessary by such delay.

Sec. 23. *Disposal of Moneys Received as Penalties.*—All moneys received as penalties for violations of the provisions of this act, less the cost of collection, and not otherwise provided for, shall be held in the State treasury as a fund available only for forest protection; provided, that one-quarter of every fine received, or such portion thereof as shall not exceed \$25, shall be paid to the person upon whose information the action was brought, and an equal amount shall be paid to the Fire Warden who made the

arrest; and, further, that if a Fire Warden is both informant and prosecutor he shall be entitled to one-half the fine, or as much thereof as shall not exceed \$50.

Sec. 24. *Moneys for Forest Purposes.*—County Boards of Supervisors are hereby authorized to appropriate money for purposes of forest protection, improvement and management; provided, however, that such sums shall not in any one year exceed one per cent of the assessed value of the County property.

Sec. 25. *Payment of Expenses Under This Act.*—The sums needed for carrying out the provisions of this act shall be appropriated annually out of any money in the treasury not otherwise appropriated.

Sec. 26. All acts or parts of acts inconsistent with the provisions of this act are hereby repealed.

Sec. 27. This act shall take effect and be in force immediately after its passage.

In addition to the foregoing sections the Bureau is considering others covering the matter of a rebate tax on planted and cut-over lands, and in regard to Arbor Day.

THE FORMATION OF LODGEPOLE PINE FORESTS

BY

MARTIN L. ERICKSON

LODGEPOLE PINE is primarily a gregarious tree. In the Rocky Mountain region the typical Lodgepole pine forest is a pure forest of even stand of nearly the same age. It covers within its altitudinal zone whole mountain sides, to the almost entire exclusion of other species, extending uninterrupted for miles through canons and along mountain divides.

Such pure forests, however, are

comparatively young as a consequence of the inevitable forest fires which pass intermittantly through the mountains, destroying the virgin timber. New forests must establish themselves over these burned districts. The mature Lodgepole forest is not always a pure forest. As the tree grows older, the dominant ones suppress and finally kill a great many overtopped trees. This leaves space for more tolerant species, as the Engelmann spruce and



Ordinary Mountain Form of Lodgepole Pine.

Alpine fir, which eventually form the trees in mixture. At the foot of mountain slopes along ravines and creeks, Alpine fir and Engelmann spruce are the predominant species in mixture with lodgepole pine; then as we ascend the mountain, we pass through a broad zone of almost pure lodgepole, extending for two or three thousand feet in elevation; coming out near its upper edge, we meet with red fir on the ridges and rocky slopes; then near the top of the mountains the Alpine pines and Alpine types occur. In general, the statement is true, that wherever lodgepole pine is found the prevailing species is lodgepole.

In the northwest, west of the Rocky Mountains, in Idaho, and Washington, the lodgepole pine was frequently observed to occur in pure stands; but cedar, hemlock, silver pine and bull pine occasionally form a considerable percentage of the stand in mixture. In Wyoming and Colorado, the bull pine and Colorado blue spruce grow with it.

Lodgepole pine is quite intolerant of shade, especially so when young. Very few seedlings of lodgepole pine are found growing in the dense virgin forest. The young plant will not grow under a heavy shade of forest trees. It is only on exposed areas that lodgepole comes up thick and vigorous. When the conditions are most favorable, as on a steep hillside where the light can enter from the sides, and where the soil is firm and of suitable quality, it is then possible for seedlings to come up under the old trees. The young slender trees in the pole forest stage, growing very thickly together, persist tenaciously in the struggle for dominance, even when only the tip of the crown receives light from above. In such cases the top is very short and thin and the tree is a tall, slender pole. The larger trees exist and do fairly well under partial shade, as when growing in rather open forests in mixture with Alpine fir and Engelmann spruce; in the pole forest the overtopped trees succumb to death very slowly. It is the killing off of

these inferior trees that make the dry dead and down stuff so common in the pure lodgepole pine forest.

The fact that lodgepole pine does not come up under much shade determines largely the composition of the forest. If much light is required for the growth of seedlings, it means that the forest will either be open in character, consisting of trees of varying ages, or else it will be dense and all the trees of practically the same age. Lodgepole pine forests occur in both of these forms, but the latter is the most typical and common.

Reproduction of lodgepole pine is so closely interwoven with the effects of fire that we might say the prime cause of new stands of lodgepole pine is the result of a burn.

Like the jack pine of the Lake States, the lodgepole pine cones do not open immediately after maturity, but the scales remain closed from two to ten years, or until made to open by heat. During this time, the ripe seed, protected by the cone scales, remains intact and seems to lose none of its vitality. Young seedlings of lodgepole pine spring up very abundantly on burned over districts, and soon clothe the entire ground with a dense cover of reproduction.

A fire passing through a lodgepole forest kills the trees, but unless the fire is severe, leaves the trees standing and the heat of the fire is sufficient to open the cones, but not enough to destroy them. The winged seeds now set free are blown long distances, finally lodging on the ground, and becoming partially covered by the next rain, germinate very readily, and grow up in the open, forming a very dense cover.

Because of its very thin and tender bark, the lodgepole pine is extremely sensitive to fire; a mere ground fire often doing considerable injury to whole forests. A severe ground fire will not only scorch the trunk badly, but will burn deep into the wood, and will either leave a mere shell of trunk, or will completely girdle it, thus entirely killing the tree. Perhaps

there is no species better able to recover itself after a fire than lodgepole pine. Instances of recovery are common where more than half of one side has been burned away. This process of healing begins with the uninjured portion and extends all the way round the stem, and after the tree has nicely started to repair itself, it often seems to grow faster than it did before the fire occurred. The probable reason

area of a burn would be limited. Burned strips and blocks are frequent in lodgepole pine regions, showing where the susceptible lodgepole has been destroyed, while other species like the red fir have been left intact. In less dense forests of mature trees the lodgepole is able to withstand ravages of fire nearly as well as other pines and spruces; the bark is thicker, the ground is not covered with that



Types of Young Lodgepole Growth About 20 to 25 Years Old.

for this is because of the more light and root space available by the death of many surrounding trees.

Lodgepole pine, on account of its dense growth, thin bark and dry resinous character of the wood, burns more freely than many other species and will prolong and extend a forest fire, whereas if the forest were composed of more fire-resistant species, the opportunity for extending

mass of dry pole stuff, and the distance between individuals prevents fire from passing from tree to tree.

The re-seeding of burned areas by spruce, fir, and most pines is effected from seed of border trees or from an occasionally surviving specimen, and not from the destroyed trees themselves, as in the case of lodgepole pine. The tender cones of these species do not protect the seed within, and usu-

ally the cones open and permit the seed to drop to the ground the very autumn they mature. A slight surface fire, then, is sufficient to kill all the seeds and sprouts. The thick-scaled, serotinous cones of the lodgepole pine remain closed under natural conditions for several years. As is usually the case, a surface fire, or often a quite severe fire, does not affect or sufficiently burn the cones to prevent them from carrying the seed through the fire; later the cones open and liberate the seeds, and re-seeding takes place from the standing fire-killed trees more certainly and rapidly than is usual by spruce and fir from living trees. The heat from a surface fire may burn a portion of the trees, and a part, if not the whole, of the top, may be heated, but not burned, and the cones begin to open so the seeds are in time set free. Of course, a great many of the seeds reaching the ground fail to germinate, but the quantity shed is so great that a sufficiently thick stand of reproduction is always assured.

As the tree fruits every year, nearly all standing trees are loaded with a crop of cones, the side branches as well as the crown portion producing them. It is easy to imagine the immense quantities of seed from a whole forest when all these cones liberate their seed at practically the same time. It is not surprising then to understand the cause of the dense lodgepole reproduction on burned over areas.

The reappearance of lodgepole pine over burned land, originally occupied by itself, is doubly assured, because re-seeding may take place not only from living trees, but also from the standing fire-killed trees. The reproduction of lodgepole is still further ascertained, because of the early fruiting of young trees. Fully mature cones have been found on small trees five to eight feet high, and from ten to fifteen years of age. Lodgepole extends its area beyond the original one a considerable distance on all sides. This continual process of renewing itself on the same ground after burns may go on for

generations; trees of different ages, bearing fire scars at different periods, indicating three of four separate crops, are found standing in isolated places overtopping the dense young growth.

From sample acres, on which reproduction studies were made, the number of specimens varies greatly, but it would be safe to say that the average acre of reproduction on a burned over area contains 15,000 specimens. As an illustration of the density of seedlings, on a gentle north slope at an altitude of 6,600 feet in a moderately deep sandy loam soil, a sample acre of lodgepole reproduction gave by actual count 17,968 seedlings. Again, on another acre in a different locality, but soil and situation practically the same, 13,632 individuals were counted. These seedlings were growing in the open, over a burned area, among considerable dead and down wood, which was not completely consumed by fire. The average age was fourteen years, varying from nine to sixteen; the mean height of the seedlings measured three feet. Many of these small trees were beginning to bear cones.

When the leafy canopy overhead is not too dense, and when some light comes in from the sides, reproduction under partial shade may take place. A good example of this was observed in Park County, Montana, where on a steep hillside facing an open meadow on the north, grew some fairly thick patches of reproduction under tall mature pines. A severe fire had passed over this region about twenty-five years since and left only the larger pines. These pines were badly injured by fire, yet continued to grow, and at the time observed the fire scars had almost healed over. When the fire passed over this region, many cones were opened by the heat, and the seeds, liberated, were left on the ground to germinate. The larger trees which survived the fire still continued to furnish some seed, and because of the light from the sides and loose canopy overhead, the seeds started and

grew. Upon analysis of sample plots the growth was found to be much slower than seedlings grown in the open. The reproduction here was not pure lodgepole, being formed of several species.

From a study of three typical sample acres, the following figures were obtained:

Number of Seedlings and Species on Three Sample Acres—Partial Shade.

Acre No.	Lodgepole.	Englemann spruce.	Dougl's spruce.	Alpine fir.	Total.
1	5123	327	1462	1198	8111
2	12099	218	2180	763	15269
3	5886	109	4253	—	10248

the stand of poles. The pole forest is very dense. A mature stand is close grown, though not particularly or necessarily dense, as the foliage of the lodgepole is very thin. The density of the old wood diminishes very slowly because of the persistent character of the species. This persistency in growth, and even competition of lodgepole, hinders proper natural thinning, and, consequently, best development of merchantable timber. For these, lodgepole pine patches of pole stuff to become merchantable log size timber is a very slow process, and often requires a hundred years. The trees in the pole forest grow exceedingly close together, and growth is so even all through that the process of thin-



Old Burn in Lodgepole Pine Forest on Lower Slope of Sleeping Cap Mountain. Shows Reproduction of Same Species from Cones on Fire Killed Trees.

The development of "pole patches," resulting in the pole forest, is the direct outcome of reproduction on burned ground. A peculiar fact is noted in regard to the density of mature forests of lodgepole in relation with

ning of less vigorous trees by suppression is very slow. Two to six inch trees, averaging ninety years of age, are common in one of these pole patches. A ninety-year-old tree in the ordinary forest is comparatively large

and usually merchantable from a tie point of view. A tree only four inches in diameter and ninety years old is seriously handicapped in a race where there is no immediate prospect for dominance and growth to merchantable size. Under the best conditions

state, for the reason that the most vigorous grow rapidly when once assuming dominance, and, in turn, suppress the weaker trees.

Pole patches are not results of natural occurrences, but, as stated at the beginning of this subject, are the di-



Burn of 1889 on Blackfeet Reservation, Near Midvale, Montana.
Densely Restocked with Lodgepole Pine.

of soil and situations these pole patches can develop into good standing timber; if the situation is not suitable, the merchantable stand is poor. Scarcely ever do we see poles growing thick and slow in good soils and situations, and continuing in that

rect results of reproduction on burned over land. The young seedlings, very dense when young, reduce their density very slowly, and by the time the tree has reached pole size, it is still struggling for dominance over its neighbors.

The red fir has much the same power of germinating on burned over areas, and will stand a much greater dryness than lodgepole pine. On steep southern slopes the dry conditions are too intense for lodgepole to maintain itself; the red fir has undisputed possession of the ground. In many lo-

The study of the ecological development in the successive steps to re-forestation of denuded and burned over areas is made much easier because of this peculiar, yet fortunate, power of the lodgepole pine to establish itself over such areas. With the ground exposed by fire to the hot summer sun,



Slopes on Northern Side of Grayback Range, San Bernardino Forest Reserve, California, Bearing Lodgepole Pine and Limber Pine. Altitude 11 000 Feet.

calities lodgepole pine and red fir were observed coming up together in equal quantities. The red fir showed a somewhat slower growth than lodgepole, but since it is able to withstand some shade, it maintains itself with ease.

the soil bakes and cracks, and it hardly seems possible that any except the most zerophytic types of vegetation could exist in such dry situations, but the seed of the lodgepole pine find here a favorable germinating bed, and in a few years after the burn, young

seedlings are well started, and in a decade this ground is completely covered with the young plants from a foot to five feet in height. After the ground becomes well shaded by dense reproduction, and a humus gradually accumulates, the soil loses its hard and dry character, and henceforth in the growth of the young forest, rapidly regains its organic composition from the decay of vegetative mould and pine needles. The intensely dry character of the soil is gradually lessening, and finally when the pole condition of forest is developed, we have that stage in the growth of lodgepole where the fiercest kind of a struggle for dominance and survival results in an almost stationary diameter increase, while the height growth is rapid. The characteristic tree now is one with a long, slender bole, small crown and shallow roots.

Those specimens in the pole forest less able to cope with the strenuous situation must eventually die, or become so weak that decay sets in, or the wind blows them down. The dominant trees continue to grow very rapidly, and soon become merchantable from a tie standpoint. The dead and down stuff, if not burned again, decays and gradually forms a humus, which enriches the soil. The density of the forest becomes very much reduced, forest underbrush grows up, and the soil

gains in organic and mineral constituents, and if of a clayey consistency, the water content has increased very perceptibly. Scattered seedlings of lodgepole pine, spruce, and fir now spring up. A deep layer of humus is formed, much moisture is retained in the ground, and if no more fires occur, the forest, by the gradual encroachment of more mesophytic types of vegetation, has again regained its virgin character.

We have now the original mixed forest as it was before the fire occurred.

The ordinary occurrence of lodgepole pine throughout its range in the Rocky Mountain region in even stands and even-aged forests, and a study of the growth and development of the pine forest from the seedling stage to the mature tree, leads to the conclusion that forest fires directly determine this uniform character of lodgepole pine forests.

A fact of mighty importance to irrigation and agriculture in the West in relation to forest covers on mountain sides at sources of streams for the regulation of water supply, is that lodgepole pine does not, under natural conditions, vacate territory when once gaining a foothold, but in spite of repeated fires, quickly re-establishes itself on the same ground and continues to extend its original area.

NEWS OF RECLAMATION SERVICE

Progress of Work of Former Projects and Result of Search for New Ones

Situation in South Dakota.

MR. F. H. NEWELL, Chief Engineer of the Reclamation Service, states that the progress of construction in South Dakota has been delayed by the indifference to or ignorance of the situation on the part of the local land owners. It is necessary before construction can begin to

obtain an agreement from the land owners to abide by the conditions of the reclamation law in regard to the subdivision of land and the repayment of the actual cost of irrigation. A number of land owners who would be greatly benefitted are hanging back and jeopardizing the work.

Over one million dollars will be in-



Truckee Valley, Looking East from Point 6 miles West of Wadsworth, Nev.

vested in construction in South Dakota as soon as the land owners take action. The enormous increase of value which will result should be sufficient to attract these men, but many of them think that by holding back they can secure benefits without making payments. In this they will be disappointed, as alternative plans are being considered to build a smaller system, and cut out areas for which the owners have not signed. It is not desired to condemn this land to perpetual sterility by so doing, however, and land owners are being given opportunity to subscribe.

The work consists of a canal taking water from the Bellefourche River, on the north side of the Black Hills, and irrigating the lands on both sides of the stream. It is probable, however, that the original plan will be modified, omitting the south side canal, and planning a smaller canal on the north side, if the land owners delay much longer. If the land is excluded it will probably not be possible to enlarge the works to cover it, as the construction is of a permanent character, and there is strong pressure brought to bear to begin construction at other points in the state as soon as this matter is definitely determined upon.

As construction has already been begun in this locality, it is the intention to give the people every reasonable opportunity, and if this is neglected, to at once reduce the system or transfer the work to another part of the state.

Progress in Oregon.

UNDER direction of Mr. John T. Whistler, engineer in charge of irrigation work in Oregon, exhaustive examinations of alternate schemes in connection with the Umatilla project are being carried on, and work on the Malheur project has been continued along the lines of the development of topography of irrigable lands. Borings with diamond drills have been made and test pits sunk in the vicinity of dam sites.

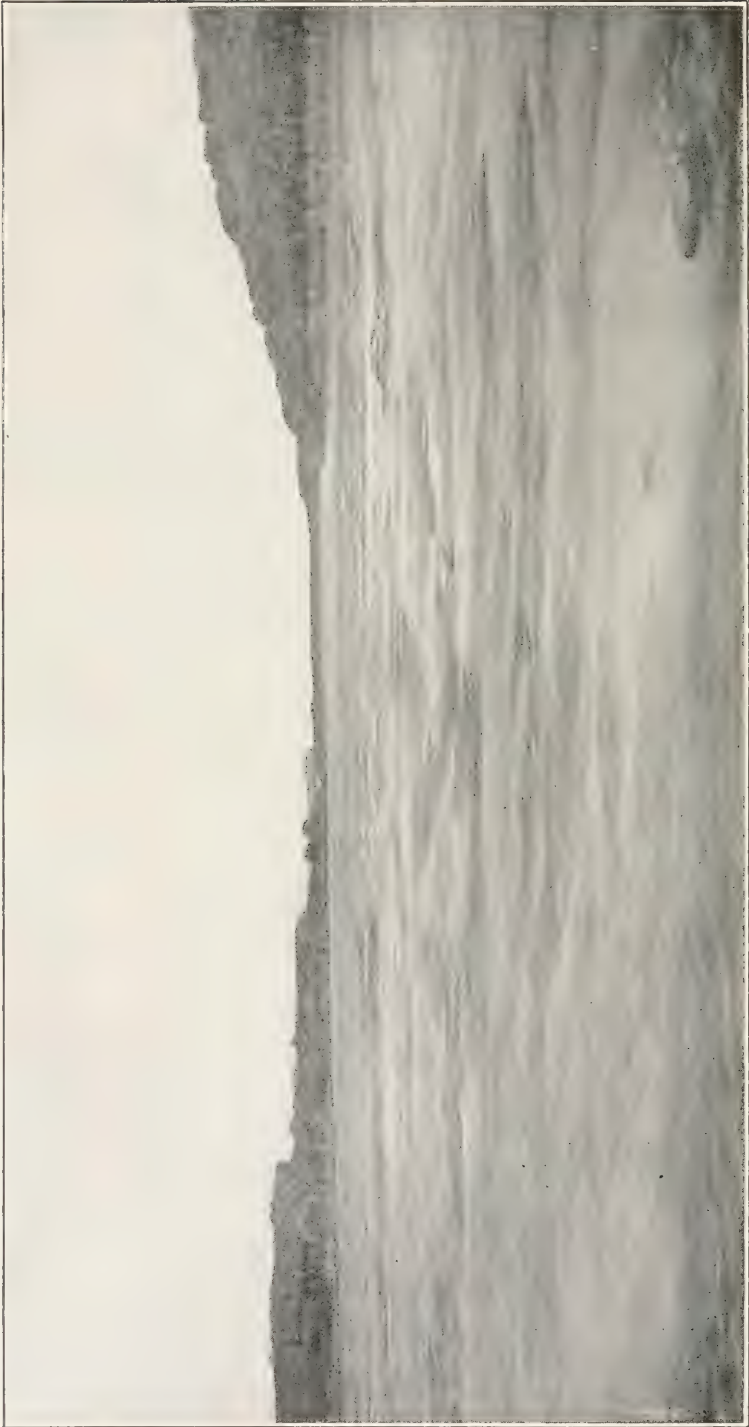
A field party investigated the possibility of diverting the waters of John Day River onto Umatilla lands, and reports that any project to divert water from North Fort of John Day River below the confluence with Bull Run is impracticable, as it would involve the construction of a canal approximately 120 miles long at a cost roughly estimated at \$1,600,000. This party will investigate the diversion possibilities at the confluence of North and South Forks below the town of Monument. A diversion at this point would justify a heavy expense, as the minimum discharge is large.

Topographic parties are busily engaged in sinking test pits and mapping various sections connected with the several projects contemplated.

The Truckee-Carson Project.

THE Truckee-Carson project in Nevada has been duly approved, various contracts let for construction, and the work is now so well under way that it is believed water will be delivered to some of the irrigable land in the year 1905. In anticipation of this, careful surveys and examinations of these lands have been made and plates prepared for four townships within which are considerable areas of public land which has been segregated under the second form of withdrawal, specified in the Reclamation Act.

These lands have been classified into farm units and the limit of area per entry which may be reasonably required for the support of a family upon these particular lands fixed. The charges which shall be made per acre upon said entries, and which are apportioned equitably and determined with a view to returning to the reclamation fund the estimated cost of construction of the project, are estimated to be \$26 per acre, to be paid in ten annual installments. The time when payments shall commence upon these lands will probably be on the first day of December of the year in which the water has been delivered to



Minidoka Reservoir Site, Idaho.

these lands during the month of April. That is to say, if the works are completed so as to deliver the water in April, 1905, then payments should begin in December, 1905. If, however, through delays, water will not be available until after April, 1905, but is available on or before April, 1906, then payment should begin on December 1, 1906.

It is expected that about 250 farms will be open to homestead entry in the near future, under the terms of the Reclamation Act of June 17, 1902, and at a later date announcement will be made as to the time when applications for water rights for said lands will be received.

The Uncompahgre Project.

THE widespread interest in the various projects of the Reclamation Service is manifest by the deluge of letters addressed to both the main office at Washington, D. C., and the local engineers. So many inquiries concerning the public lands available for settlement under the Uncompahgre Valley reclamation project have been received that the District Engineer has prepared a circular calling the attention of persons who anticipate entering upon such lands to the following facts:

"This project includes parts of Montrose and Delta counties, in Western Colorado, these tracts constituting the Uncompahgre Valley, traversed by the Denver and Rio Grande Railway, and including the towns of Montrose, Olathe, and Delta. It is estimated that approximately 185,000 acres will be covered by the system, of which about 125,000 acres will eventually be irrigated. Of these lands more than 100,000 acres have passed from the control of the Government, so that a comparatively small amount still remains in public ownership. All of the public lands lie along the borders of the tract to be irrigated, and in general it cannot be definitely known what lands are irrigable until

the final location of the canal lines has been made and approved.

"All of the public lands referred to are in an arid condition, incapable of cultivation until water is available for their irrigation, and there is no possibility of watering the lands from any other source than from the system proposed by the Government.

"The Secretary of the Interior has directed that as soon as it is practicable all of the public lands shall be divided into homesteads or farm units, but one of which can be entered by a qualified homesteader. In making such subdivisions the engineers will be guided by the character of the soil and the topography, to the end that there shall be included in each homestead as nearly as may be the prescribed amount of irrigable land of average quality, and lying suitable for both irrigation and drainage with reference to the ditches for these purposes.

"The lands have not yet been classified, nor have the exact tracts which will be irrigated been determined, and the charges for water and conditions on which it will be furnished have not yet been definitely fixed.

"The amount of land which one person can take will probably be limited to 40 acres of good land. Occasionally where desirable lands are cut by ridges, arroyos, and rock outcrops, the total entry may be made large enough to include 40 acres of good land. The limit of the homestead entry has not yet been definitely fixed, however.

"The work of construction of the proposed system is at this date but just commenced, and it is not possible that any water can be delivered prior to the crop season of 1908.

"Those who may prefer to purchase lands rather than make homestead entries will find considerable land of good quality under the project owned by private individuals and corporations, which can be purchased at prices varying from \$10 to \$50 per acre. Parties purchasing such lands should inspect them on the ground, so that they may know what they are buying.

"While it is true that the construc-

tion of the project will furnish work to a considerable number of people, parties contemplating a livelihood in this way are advised to go upon the ground in person and to investigate the conditions before incurring the expense of moving.

"Attention is also called to the circular of a general character, approved by the Secretary of the Interior, under date of March 31, 1904."

The circular referred to may be had upon application to the office of the Geological Survey, Washington, D. C., or to any of the local offices, and applies to all lands withdrawn under the terms of the Reclamation Act.

Owens Valley, California.

THE engineers of the Reclamation Service in California have made varied and thorough examinations of the land and water conditions in Owens Valley, in that State, and the reports to the Chief Engineer seem to indicate that this valley has particular

merits to favor it as an advantageous location for an irrigation project. Among these are mentioned an abundance of water power, fertile soil, congenial climate, nearby markets for all agricultural projects in Tonopah and Gold Field, and a possible outlet to Los Angeles in the future.

The total area of the valley is roughly estimated at 280,000 acres, of which 75,000 acres are first-class land, 50,000 acres second-class, 80,000 third-class, and 75,000 acres fourth-class land. First and second-class land is all of value as soon as water is applied. Third-class land will need drainage and washing and will require considerable work to bring into shape, and fourth-class land is too rough for irrigation or is waste from some other cause.

This estimate would seem to indicate that there is more land than water for irrigation, and the problem will therefore be to select the most desirable land. Little difficulty should be experienced in such selection, however,



Making a Road to Cement Plant, Salt River Project.

as the alkali land lies in a more or less continuous body along the lower parts of the valley and will probably be allowed to lie in its present condition, as it furnishes a certain amount of pasturage in salt grass, and its present owners claim that it is quite valuable for winter feed. It is probable that if the irrigation systems are confined to the lands at present holding water rights and to such new lands as are in good condition for irrigation, and which will require a minimum expenditure for drainage, all the land for which there is water can easily be found.

Should the volume of available water exceed the present expectations, all the land susceptible of irrigation that could be supplied would be reclaimed, as the kind and amount of alkali which the land contains would undoubtedly permit of reclamation.

Owens Valley is suffering at present from an over-abundance of water. Thousands of acres are damaged by seepage water, and some system of drainage is as desirable as more extensive irrigation. Large areas of swamps could be drained and rendered fit for cultivation, and the water thus developed on the upper lands would prove available for the irrigation of lands lower down the valley. Should the Long Valley dam site prove a good one, and surveys be ordered, it is probable that a study of the character of these return waters will be made.

Salt River Project.

THE extreme high water in Salt River, caused by the September floods, damaged the Phoenix-Roosevelt road, built in connection with the Salt River irrigation project, to a considerable extent. On long portions of the road, where it was expected no work would have to be done, mud was deposited to a depth of from two to four feet, making it almost impassable. The bed of the channel shifted and a large amount of material was deposited at various points along the river,

raising the general surface in places some three or four feet.

Up to October 16 eight tunnels had been completed, with the exception of the lining, and work on the upper portion of the headworks tunnel is progressing favorably, although the extreme care and skill required on this work necessitates great caution.

The engineer in charge of the Salt River project, not being satisfied with the former reports on the sources of salt in the river, directed a party to proceed up the stream to the source of the salt, or until fresh water was reached. A steadily increasing amount of salt was found until the party came to Carrizo Creek. The total amount of salt in the river below the mouth of this creek was 1,650 parts per million. The total amount above was 83 parts, and the salt contents of the creek at the mouth were 9,900 parts.

Just below the salt springs in this creek the amount of salt reached 14,000 parts, and just above, 198 parts. A study of the variations of salt in the river from Livingstone to this point shows conclusively that by far the greatest quantity of salt is furnished by this creek. The salt springs extend over a distance of about half a mile, the discharge from them being three to five second-feet.

An investigation will soon be made of the feasibility of controlling these springs, as the value of irrigation in the valley will be enormously increased if it is found possible to control the salt in this river.

The new cement mill was nearly completed during September, and fire brick for lining the cooler portions of the kilns were manufactured. Drilling on the power canal, the construction of buildings and other miscellaneous work is being carried forward rapidly.

Planning for North Dakota Irrigation.

A BOARD of consulting engineers of the United States Reclamation Service, consisting of Arthur P. Davis, George Y. Wisner, C. H. Fitch,



North Platte River Looking Upstream from 200 Yards Below Dam Site of
Pathfinder Reservoir, Wyoming.

and W. H. Sanders, recently convened to discuss the possibilities of irrigation in North Dakota.

It has been found that the use of gravity systems, except in the Fort Buford project, is out of the question, and the problems connected with the raising of water by pumping are now engaging the attention of the engineers.

Surveys and investigations by field parties under the direction of Mr. H. A. Storrs have disclosed the fact that bench lands suitable for irrigation by pumping water from the river, exist near Bismarck at elevations of from 25 to 30 feet above the river.

Besides this section some possible locations for pumping plants are believed to exist on the Little Missouri, Mouse, Hart, Knife, and other rivers in North Dakota which will be included in the present investigation.

On many of the proposed projects small streams and washes cut across the irrigable lands and at certain seasons of the year carry large quantities of water. Some of this water could be stored by building low dams, thus lessening the amount of irrigation water that would have to be pumped. It is believed that the coulees and deep gulches which frequently occur might be converted in some cases into canals to conduct water from the river back to the pumping plant, or from a pumping plant at the river bank back to another plant for a higher lift at some distance back from the river bank.

The cost per acre for pumping plants, canal systems, and fuel supply cannot be estimated until the present season's work secures data as to the extent and elevation of benches, size and location of plants, etc., and upon this the feasibility of the project will largely depend.

Land Withdrawals for Milk River Project.

IN compliance with the recommendation of the Acting Director of the Geological Survey, the Secretary of the Interior has temporarily withdrawn from any form of disposition whatever, under the first form of withdrawal authorized by Section 3 of the Act of June 17, 1902, for irrigation works in the State of Montana under the Milk River project, certain public lands in the following townships:

For Chain Lake reservoir site—

T. 33 N., R. 13 E. M. P. M.
T. 34 N., R. 12 E.
T. 34 N., R. 13 E.
T. 35 N., R. 12 E.
T. 36 N., R. 11 E.
T. 36 N., R. 12 E.
T. 37 N., R. 10 E.
T. 37 N., R. 11 E.

For Lonesome Lake reservoir site—

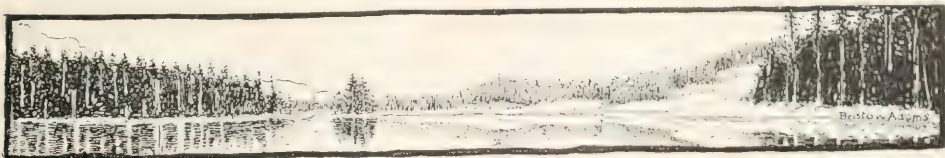
T. 29 N., R. 11 E. M. P. M.
T. 29 N., R. 12 E.
T. 30 N., R. 12 E.
T. 29 N., R. 13 E.

The withdrawal of Lonesome Lake reservoir site is for the Marias subproject, under the Milk River project.

Studying Colorado River.

M R. E. C. MURPHY, general inspector of stream gauging under the United States Geological Survey, has been detailed to make a comprehensive study of all hydrographic data of the Colorado River Basin, with a view to estimating the effect of storage upon the overflow of valleys on the lower river.

He will bring together and arrange for publication all the facts bearing upon the rainfall and run-off of this basin, consulting all the present office records regarding reservoir sites to obtain data which may aid him in making a complete and detailed report.



THE NATIONAL FOREST RESERVES

The Purpose of Their Establishment—How They Have Grown, and the Important Ends They Will Conserve

EXCLUDING the two reserves in Alaska, which cover nearly 5,000,000 acres, there are now in the United States 51 forest reserves, with a combined area of 57,833,974 acres. These reserves are divided among 13 States and Territories of the West. If they redeem arid land only to the extent of their own areas, it would mean 373,337 new farms of 160 acres each—for water is the West's greatest need, and it is now recognized that water conservation is to be the most important service rendered by the reserves. What this would mean in the way of increased agricultural wealth it is easy to see.

The people of the United States, as a whole, have little idea of the enormous magnitude of the interests affected by the Government's forest reserve policy. Timber supply important as this is, is a relatively small part of the whole purpose. The reclamation of millions of acres of arid land, a sustained or heightened fertility for other millions of acres of farm lands, and, finally, the safeguarding for the future of pasturage for millions of head of sheep and cattle are already certain results of that policy. It contemplates furnishing the present and thousands of prospective settlers wood, water, tillable lands, and prosperous homes. Roundly stated, the purpose is to give these forest reserves their highest utility to all who use them now or will use them hereafter.

This is clearly a work of stupendous proportions. Irrigation, which will prove the salvation of millions of acres of these lands, can not realize its largest possibilities unless the watersheds of the West are under conservative forest management. Great damage has been done there by overgrazing, reckless lumbering and, most of all, by fires. Reserves were established to

stop this damage and to give the forests their greatest usefulness by conserving the water supply without shutting off the supply of timber. On account of the expense and natural conditions involved, there is a limit to the size of impounding reservoirs, hence the necessity for preventing their overflow by floods, and for making their supply regular, that all the water possible may be saved for use. Forests are the chief agency in this work, and to maintain them is absolutely essential to the reclamation of the arid West.

This use of a forest, however, is not at all inconsistent with its use for many purposes. Lumbering, when rightly done, is an advantage, not a detriment. Grazing, when regulated, does not injure the forest, and prospecting, locating, and developing mines are not interfered with by reserve restrictions. Thus the Government, in establishing reserves, in no sense withdraws the forests from use. On the contrary, while all their present uses are continued, their greatest power for good is kept from injury and increased in value by the wise and careful protection afforded the reserve management. Only under such management can these forests most effectively aid irrigation in reclaiming thousands of square miles of waste lands, and in building homes over vast areas hitherto regarded as impossible of settlement.

The Bureau of Forestry has had during the past summer 15 agents in the field investigating actual and proposed forest reserves. If they discover that agricultural lands, or lands more valuable for other purposes, have been included in reserves, they will recommend their immediate exclusion. If they find land which will be more useful when reserved than

when not reserved, they will recommend that it be added to an adjacent reserve or form a new one.

Often the hardest task of the Bureau agents is in reconciling conflicting local interests. Sheep and cattle men may be disputing over the same grazing grounds, or each class may be at war over individual grazing rights. Again, owners of farms or of water-power plants may object to any grazing in the forests, lest the water supply be injured. In all such cases the Bureau experts must examine and report on every phase of the question, that, so far as possible, absolute justice may be done to all interests. In perfecting present boundaries and increasing reserve areas temporary local injury to some interest is sometimes inevitable. This is

most unfortunate, but these occasional injuries can not weigh against the importance of the general purpose of forest reserve establishment.

In all of this work one large fact is to be recognized. It is that in the execution of the policy of reserving from private acquisition such parts of the public domain as are suited to forest growth and most useful under permanent forests, a far-reaching and beneficent policy is being carried out. Under it the government is acting to secure perpetually in the interests of the whole people vast wealth-producing resources which otherwise, under the stimulus of immediate private profits from lumbering, grazing, and the like, would in no long time be lost forever.

A TRIP THROUGH THE SAN BERNARDINO FOREST RESERVE

BY

GEORGE BELLIS

THE San Bernardino Forest Reserve is located in the San Bernardino range of mountains and in San Bernardino County, California. It was established in 1893 largely as the result of the persistent efforts of the late Col. Adolf Wood, manager of the Arrowhead Reservoir Company, and other public spirited men of San Bernardino. It lies in a north and northeasterly direction from the San Bernardino Valley, famed as producing one-third of the orange crop of the entire State, and also noted for its irrigation systems, which are far advanced and nearer perfection here on the whole than at any other place in the United States. Enormous pumping plants, miles of concrete-lined canals, and tunnels through the mountains are very much in evidence throughout the valley. Thousands of dollars are here invest-

ed for the maintenance of the present water supply. Costly pumping plants have been installed in some sections of the valley, in all over eight hundred, and money has in no wise been spared to continue, and in hope of increasing the water supply as it was at the beginning of the present dry spell, which has lasted about six years.

Despite all this, water has become scarcer and scarcer, each year since 1898. Some of the big canal companies who are distributing water for domestic purposes do so provided certain economical rules for its use of water are strictly adhered to. One company furnishing water to be used on lawns in Riverside make a special contract for this use of water. It reserves the right to discontinue it without notice should it be deemed necessary, and allows its use before 7 A. M. and after 6 P. M. only, so that the



Wonderful Results from Irrigation as Shown at Redlands, California. . . Arid Land 15 Years Ago, Now a Most Prosperous Community.



Brookside Avenue, Redlands, California.

lawns might get every benefit possible and the evaporation will be as little as possible.

It can be understood, therefore, that after the great expense incurred in the conveying and saving as much of the water as possible had failed to supply an abundance for all needs, the people of this community are now almost as a whole crying out against the six or seven lumber companies who have in the meantime been denuding the watershed from which the water is obtained.

When the creation of the reserve was first agitated, comparatively few thought enough of it to give the matter serious thought, while others openly opposed it as a scheme of big lumbering interests to get the government to protect certain timber for their special benefit. The writer met a few who are a little "sore" about the matter even now, but in every case he was able to trace it to some personal prejudice.

In my trip through the reserve, I found all the forest rangers in the active performance of their duties. They were uniformed in corduroy trousers, blue flannel shorts, gray hats, canvas leggings, and blue fatigue coats, and carrying a brush, knife, and either a shovel or a rope, and sometimes both. I found also that at certain convenient intervals throughout the reserve were kept fire fighting tools and cooking utensils for the use of volunteers or extra men should their services be necessary.

The uniform of the reserve patrol force is the result of the wide-awakeness and personal observation of the superintendent, Mr. E. B. Thomas, and it impressed the writer as a very excellent plan and one that should be adopted in all the reserves. It gives the visitor to the reserve the impression that the rangers are there for a particular purpose and are not merely residents of the mountains, who draw a salary for wearing a badge and get a "rake-off" from their friends for special privileges. It increases the dignity of the ranger's position, and at

the same time does not work a hardship in the way of an extra expense, as the uniform selected by Mr. Thomas is not only very serviceable but also quite inexpensive. Another advantage of the uniform is to make the ranger where inclined to be at all careless about his duty, more careful, as the uniform is readily recognized at a distance, while one would have to be quite close to a ranger to recognize him by his badge alone. So that should a ranger be inclined to shirk his duty at a fire or in the patrol of his district, he will be more attentive to duty if he is uniformed.

Having just completed a trip through the San Bernardino Valley and having in mind the rapid and rather alarming shrinkage of the artesian belt and the gradual decrease of the water supply in the last few years and remembering that the reserve furnishes the only watershed from which the valley obtains its supply, I paid special attention to the ground cover, as there is practically no timber on the southern exposures. I found the south slopes of the mountains below the 3,500 feet level covered by a growth of chapparral, composed of chemise and scrub oak. Where the chapparral had escaped fire it was found to be quite thick and affording a good ground cover. In some of the canons on the southern exposures there are a few big cone spruce that seem to be doing well. It occurred to the writer that it might be of advantage to do something to increase this small stand, and aid nature a little. If these trees grow here naturally under present adverse conditions, they might thrive under better ones. They are, it would seem to the writer, of more value, too, than the knob cone pine (*Pinus attenuata*), because they are of commercial value as well as a good ground cover. There are indications of spruce of considerable size having been cut from some of the canons. These were probably cut for wood, being nearest the valley.

There is no indication of any other timber ever having existed on the

southern exposure' below the 3,500 feet level. About this altitude there is found in places the knob cone pine, though not in great numbers or of large size. In the area visited by fire last December the writer found the trees completely killed. Especial attention was paid to the ground conditions in order to find some indications of the seed starting, but without success. Of the fire area, where the chaparral grew, was found an abundance of young growth as the result of coppice. The scrub oak was especially noticeable, as affording considerable cover, to the black, dry ground. This would go to recommend the chaparral as a ground cover on southern slopes, where it is impossible to grow timber of commercial value. It covers the ground much better than the knob cone pine and will grow on steep slopes where pines will not. It is much more resistant to fire and will send up coppice to cover the ground soon after the fire.

Near the crest the cutter pine is found and in some few places where uncut a fairly good stand is observed.

At Fredalba at an altitude of 5,600 feet a good stand of Jeffrey pine is seen where uncut. At this place the mill of Brookings Lumber and Box Company is located, with a capacity of 60,000 feet per day. The Brookings Company own about 650 acres of what was until cut the best timber land in the reserve. Of their holdings about 5,000 acres have been cut over. The slogan of the Brookings Company seems to be, "Get lumber, all of it, and quick." The result is that when they leave, the forest is denuded. They are cutting everything that will make a 2x4 and are leaving all brush where it falls. About 2,500 acres of their property was visited by fire, which originated from one of their donkey engines, and the result is that this much of their holdings is entirely bare. The fire also spread to the adjoining government land, burning over about 1,500 acres of it, making a total area of 4,000 acres. The long haul to the valley below, and the small

demand for wood as fuel, make it unprofitable to utilize the tops for cord wood, and as a result all this is left to make a big hot fire when it is once started by a spark.

The area visited by the fire last December is still entirely bare. There is a movement on foot at San Bernardino which has as its object the purchase of the holdings of the Brookings Company in order that the remainder of the timber owned by them may be saved, or at least cut by systematic methods, thus preserving the young growth and some of the mature trees for seeding. The writer is of the opinion that this would be an excellent plan. There is undoubtedly a good deal of timber on the Brookings property that could be cut without serious damage to the watershed, should conservative forest methods be strictly adhered to. Tyler Brothers and later Mr. James Fleming cut considerable timber in the reserve. These gentlemen cut for constructive purposes only and took nothing that would not scale two feet at the butt. They used oxen and horses in logging and as a result the young growth was not broken by having logs dragged over them by donkey engines. The Brookings Company are cutting to make boxes, and practically everything is cut, and what is not cut is either broken down in logging or else consumed by the fire that is fed by the limb stuff and brush left after cutting. If this denuding is allowed to go on as at present, it will be but a short time before there will be no timber left to condense the many fogs that pass over the mountains, and which are condensed and precipitated by the cool forest when the stand is heavy. The timber is confined to the northern slopes of the southernmost ridges, and consists of Jeffrey pine, cedar, and fir, underneath which is a fairly good stand of young growth, among which is dogwood. Especially is this true in and around Little Bear Valley, where the Arrowhead Reservoir Company is building a dam and a series of tunnels, through which

they are to convey the water to the south side of the mountains, and thence through the canals and flumes to the valley. Several electric plants are also to be installed, where the drop into the valley is made. Another very discouraging thing is the way in which the lumberman totally disregards the interests of the reserve. For instance, the San Bernardino Lumber and Box Company recently burned over between five and seven acres on which to pile 500,000 feet of lumber. It is only fair to say that the other lumbermen are not quite as bad in this respect as the Brookings and San Bernardino Company.

While the timber is for the most part on the northern slopes, it certainly should be saved if possible at any cost, as the use of the water from this shed is demonstrated by the Arrowhead Company in their turning it back

to the valley, and other projects would certainly spring up should enough water be available.

There are about 2,500 head of cattle being pastured in the reserve at this time, but this is not thought to be doing any harm, as the permits are issued by the Department of the Interior on the recommendation of the supervisor. Approximately 15,000 campers visited the San Bernardino reserve from June to October of last year, and the record of only one severe fire speaks volumes for the ranger service. The number of small fires has of course increased very materially with the campers in the last few years, but they have been quickly controlled by the rangers, who are twelve in number, under the immediate charge of first-class ranger, N. O. Torstenson.

IRRIGATION IN HUMID REGIONS

The Practice Extending to the East and South Where the Artificial Application of Water to Crops Brings Splendid Returns

THE advantages of irrigation in the humid climates, merely as a supplement to rainfall in ordinary or extra dry seasons, are forcibly presented in Bulletin No. 148 of the Office of Experiment Stations recently issued by the U. S. Department of Agriculture. The reports of a number of irrigation plants in the vicinities of eastern cities go far to show that as population increases and land becomes more valuable, the zone in which irrigation can be profitably employed will be more extended, as it has been in Europe, where farmers have found that there are few sections where irrigation will not pay simply as an insurance against drought.

The bulletin states that a grower of berries in the vicinity of Poughkeepsie,

N. Y., has found that artificial watering guarantees a perfect stand and rapid growth of newly set plants, the highest quality of product, and maximum crops. Owing to dry weather and high temperature during the season of 1903 his berries had colored and hardened but did not sweeten. The application of 10,000 gallons of water in a fine spray and 25,000 gallons between the rows put the berries in fine condition for picking. He also found that to irrigate after applying chemical fertilizers dissolves and distributes the plant food and lessens the danger of injury to plants.

To water market gardens near New York City, on Long Island, and in New Jersey, small plants consisting of pumps, storage tanks, and piping are used with such success that their

owners claim large returns on the money invested. One man stated that he would not attempt to garden for profit without such an assurance of plenty of water when needed. Some

loss. Within the last year or two the plan of sinking $1\frac{1}{2}$ to 2-inch wells has been tried and its success is leading to their extended use. A good 2-inch well will furnish water for half a sec-



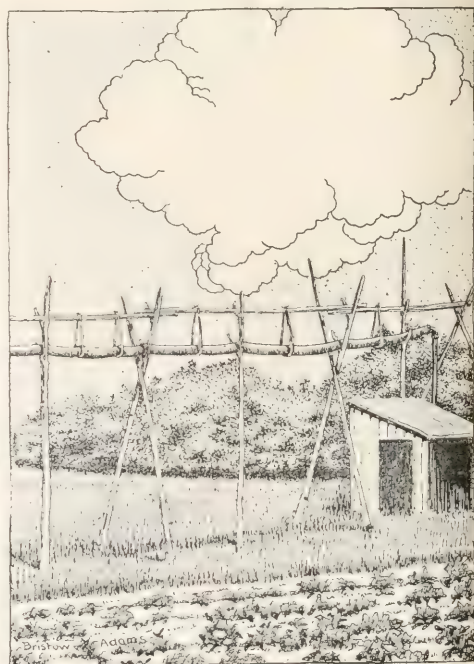
Movable Sprinklers on the Farm of David Astle, Vineland, N. J.

gardeners buy water from city supplies and find it more satisfactory than to install their own pumping plants.

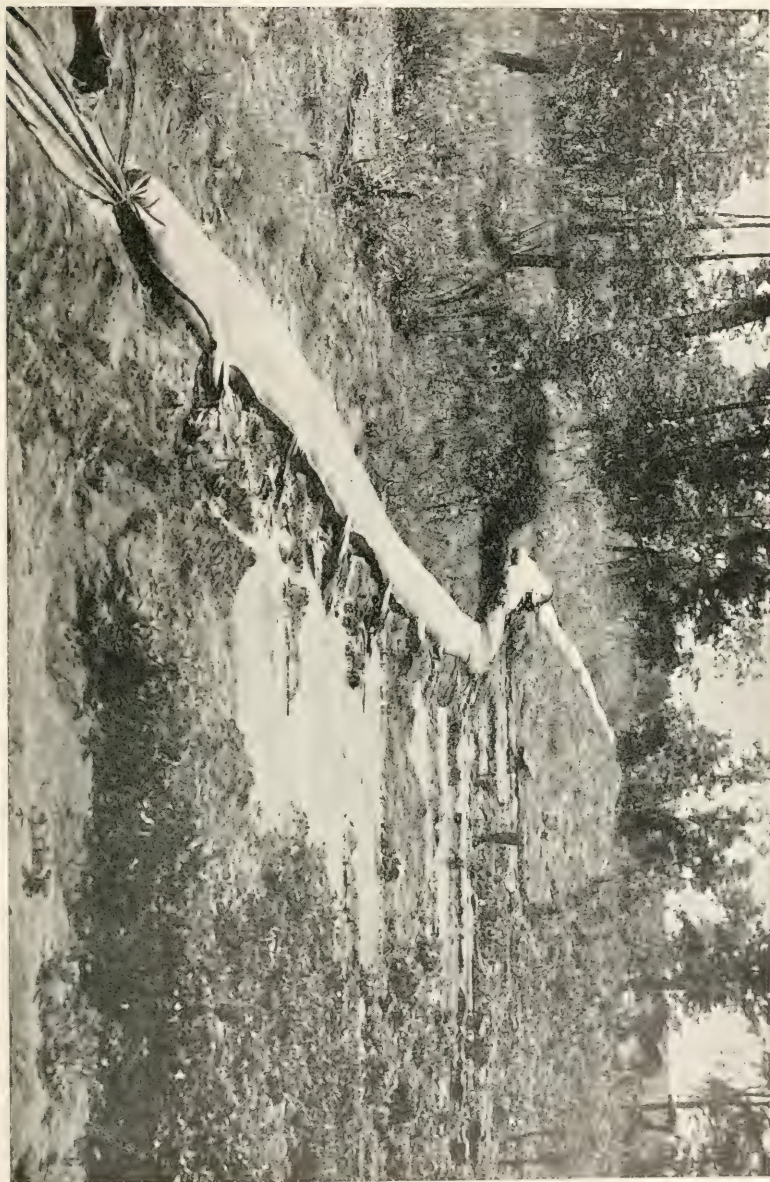
Descriptions of pumping plants of various sizes and styles with their storage basins and distributing pipes are given in this bulletin so that those intending to try artificial watering may profit by the experience of several successful irrigators.

Striking testimony in favor of irrigation is furnished by the careful comparison of crops from irrigated and unirrigated plats of strawberries, asparagus, nursery stock, and onions at the Missouri Agricultural Experiment Station. Not only were yields larger, but in the case of asparagus unirrigated rows were affected with rust while the irrigated plants were entirely free from the disease.

A portion of South Dakota which is noticeably benefited by a supplementary water supply in the James River Valley. In the first attempts to utilize this supply of underground water wells were made so large that the excessive cost resulted in financial



Canvas Hose Supported on Poles from Gasoline Engine Pumping Station.



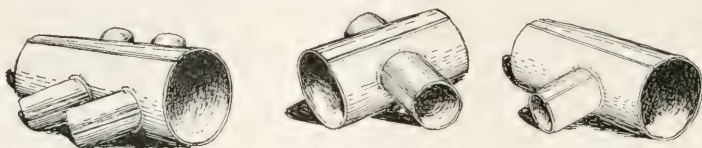
Distributing Water from a 12-Inch Canvas Hose, Stevens Point, Wis.

Courtesy U. S. Geological Survey.

tion of land. An oversupply of water in the first experiments produced conditions that prejudiced many farmers against the practice, but later tests show that no injury need be feared

evaporation will leave a deposit of salt, so that care must be taken that the soil does not become too wet.

The bulletin as a whole shows the great advantage of irrigation as a



Forms of Galvanized Iron Laterals for Use With Oiled Duck Hose.

where water is properly used. All cases of deterioration are directly traceable to an oversupply of water. An excessive amount of water in the soil will smother the rootlets and on

means of increasing production and as an insurance against drought, even where the expense of securing a water supply is great.

Education in Forestry in England

BY

W. R. FISHER

ALL considerable European countries, except perhaps Portugal, have forest schools. In France there is the National Forest School, founded at Nancy in 1826, where, besides the candidates for employment in the State forests, about 350 other students of all nationalities, but chiefly Roumanian, English, and Belgian, have been taught since 1830. There is in France also a school for forest guards and foresters at Barres, in the Department de Loiret, and the best students from this school can rise to the position of forest officers, and may attain the grade of Inspecteur des Eaux et Forêts, corresponding to our Deputy Surveyors of the Crown Forests, though they cannot, on account of their superior age to that of the Nancy students, become Conservateurs, a rank which is not usually attained even by the Nancy men until they have been in the service for about thirty-five years. There are numer-

ous schools of forestry in Germany, the principal ones being Eberswalde, Munich, Thrandt, Tübingen, Giessen, etc. There are several forest schools in Austria, also in Norway and Sweden, one each for Russia, Italy, Switzerland. Holland (chiefly for the Dutch Colonies), Spain, and Belgium. The Japanese have a forest school at Tokio, there are several in the United States, one in India, and one in Burma.

When we consider the extent of the British Empire, and the large area of forests in the British Colonies, it is evident that the establishment of forest schools is necessary in Canada, Australia, New Zealand, South Africa, and Ceylon. Much more has been done for forestry in India and in our Crown Colonies than in the larger, self-governing Colonies, except in the Cape of Good Hope, where there has been a scientific Forest Department for the last thirty years. There are Forestry Departments, under trained

officers, in Ceylon, the Transvaal, Uganda, Mauritius, the Soudan, and the Straits Settlements, and the West Indian forests have been inspected officially by an Indian forest officer with a view of establishing a forestry department. What is now wanted for the Empire is the establishment of a Forest School in Britain, which will train the higher forest officers for India and the Colonies, and instructors in forestry for the larger Colonies, where superior and inferior schools of forestry, on the model of Nancy and Barres, must soon be established. For service at home, the future higher officials of the Crown forests will require thorough instruction in forestry, and also the instructors in forestry at the Agricultural Colleges, at Edinburgh, and at the school for woodmen established at the Forest of Dean, another of which class is proposed for Alice Holt Wood. Such a school will also afford instruction in forestry to the sons of our landowners and to men preparing at our Universities for the posts of land agents to large estates.

I propose here to give a short account (chiefly taken from Ribbentrop's *Forestry in British India*) of the instruction adopted for our Indian forest officials, who have hitherto formed the principal corps of trained foresters in the British Empire, and to discuss the advisability of now extending this instruction so as to include all the classes mentioned above, whose services are required to make forestry a serious pursuit throughout the Empire.

The necessity for establishing a Forestry Department in India was first realized in 1806, when Captain Watson was appointed Conservator of Forests in Malabar, chiefly to protect the growth of teak and other timbers for the Navy, but a reaction ensued in 1823, owing to complaints of the traders, and the conservatorship was abolished. Great ravages were then allowed in the State forests, and it was not till 1842 that Mr. Conolly commenced the plantation of the famous Nilambur teak plantation, and

in 1847, Dr. Gibson, a botanist of note, was appointed Conservator of Forests, in Bombay, and in 1856 Dr. Cleghorn, Conservator of Forests in Madras. In 1852, Pegu, with its splendid teak forests, was annexed, and Dr. McClelland appointed superintendent of these forests, but a permanent policy for the forest administration of India was first laid down by Lord Dalhousie in 1855, Dr. Dietrich Brandis, brother-in-law of General Havelock, being appointed superintendent of the Pegu forests in 1856, and the forests of Tennasserim and Martaban being added to his charge in 1857.

Dr. Brandis then introduced those principles of enumeration and organization, to the working of the forests, that form the basis of our present working plans, and created a practical system of working the Burmese forests of teak, with due consideration to the perpetuation of the trees by natural and artificial regeneration.

His conservative policy interfered with the gains of timber merchants, who were very powerful in Rangoon, and they prevailed so far on the Government of India that orders were issued to open all the Pegu forests to private enterprise, but the selection of the trees to be felled was left to the control of the Forest Department. Fortunately the Tharawaddy forests were still worked under complete departmental control, and after a few years' experience the state lost about £1,000,000 in the open forests, whilst the Tharawaddy forests produced a large regular income. Canadian timber merchants still form the greatest obstacle to scientific forestry in the Dominion of Canada.

Dr. Brandis had gained the day against the timber traders, and in 1862 was appointed Inspector-General of Forests for the Government of India.

Up to this time, officers were appointed to the Indian Forest Service without any special training, but Dr. Brandis came home in 1866 and induced Lord Salisbury, who was then Secretary of State for India, to ap-

point trained men for the service. Dr. Schlich and Mr. Ribbentrop, who were trained in Germany, were then sent out to India, and these officers, both of whom eventually became Inspector-General of Forests, greatly assisted Dr. Brandis in his work of establishing a scientific Department of Forestry in India. At the same time, eight candidates were appointed by the Secretary of State for India to undergo training in France and Germany, and these men went to India in 1869. Another batch of trained forest officers went out in 1871, and the Continental training was continued in Germany till 1875, and in France till 1886. Dr. Brandis was deputed to Madras, in 1881, to reorganize the forest service in that Presidency, and retired from the service in 1882, becoming Sir Dietrich Brandis, K.C.I.E., and was also appointed a Fellow of the Royal Society, and now, in his eightieth year, he is still working at Kew at a comprehensive manual of the Indian forest flora.

Dr. Schlich, who succeeded Sir D. Brandis as Inspector-General of Forests, was deputed home in 1885, to inaugurate a course of instruction in forestry, at the Royal Indian Engineering College, Cooper's Hill, a place admirably suited, owing to its proximity to the Windsor Forest (14,000 acres), to the beech woodlands in the Chiltern Hills, and to the coppices-with-standards in Surrey and Sussex, and to Kew Gardens, for instruction in forestry and botany.

The course of instruction at Cooper's Hill comprises drawing, surveying, road-making and building, accounts and German, elementary chemistry, and the chemistry of soils and physics, entomology, botany, geology (including that of India), and forestry. Thoroughly practical instruction in forest nursery work, and in planting operations, have been given, and the students have also been taught methods of natural regeneration of forests and thinnings in the Chiltern Hills, and in the fine French forests. Besides this, they have spent nine

months every year in the Prussian forests, where they are placed only two together, under specially-selected forest officers, so as to learn the practical management of large areas of forests.

Cooper's Hill College is now to be closed, as the Secretary of State hopes to recruit the Indian engineers from the various engineering colleges in Britain, coupled with experience gained in one year's practical work with some engineering firm. Fresh arrangements have, therefore, to be made for the instruction of our Indian forest students, and this it is probably intended to secure at one of our Universities. It is no longer necessary to have recourse to the Continental forest schools, for the following reasons:—

Since 1886, when training our men at Nancy was abolished, considerable progress has been made in forestry in Britain. Dr. Schlich, who, besides possessing a thorough knowledge of theoretical forestry, has managed a woodland of 3,000 acres in the Ardennes for the last ten years, and also more recently the 8,000 acres of the Duke of Bedford's woods, is a good, practical forester. No one can be better qualified for starting a superior forest school for British and Colonial forestry, the necessity for which I have already explained. Continental forest schools do not, as a rule, take a wide view of forestry. Each State in Germany has its own system of management, which is not always applicable to other countries, thus neither the clear-cutting system, practiced in Saxony and elsewhere, nor the compartment shelter-wood system, are generally applicable to India, where the selection system and the system of coppice-with-standards prevail, and where it is hoped to introduce the group system, which at present is carried on only in the Grand Duchy of Baden, in Europe. It is also necessary that our Indian forest students should have some notions of tropical and sub-tropical forestry, and should know something of Indian history, In-

dian law, and land management, which they will not acquire at a Continental forest school. A succession of experienced Indian forest officers, who have been trained by Dr. Schlich and myself, will be available eventually to succeed us as instructors in forestry, while their services would not be available at a Continental school.

Forest management has also made progress in Britain during the last twenty-five years. The woodlands of the Duke of Bedford are now managed according to a continuous working-plan, so are the High Meadows Woods attached to the Forest of Dean, the working-plan for these having been prepared by my lamented friend, Mr. H. C. Hill, who was for some time Inspector-General of Forests in India. Lord Selborne's woods, near Woolmer Forest, are managed according to a working-plan prepared by Dr. Nisbet. Mr. Munro Ferguson's woods in Fifeshire, the Alice Holt Woods attached to the New Forest, are also under working-plans. The magnificent forests of France and Germany have been placed at our disposal by the

friendly Governments of France and Germany for our students to learn the management of forests on a large scale.

Sir W. Thyselton Dyer, in giving evidence before the late Committee appointed by the Secretary of State for India, to arrange the future teaching of the Cooper's Hill students, said that one of the most difficult duties that fell to him, as official adviser to the Colonial Office, was the selection of forest officers for the Colonies, and that under present circumstances he could not find properly trained British candidates for such posts. Surely we no longer wish for Colonial forestry appointments to be held by foreigners, and the only way to avoid this in future, as well as to afford the best training for our Indian forest officials, and to keep up a high standard of forest training for our landowners, land agents, and for future instructors of forestry throughout the Empire, is to take the present opportunity of establishing an Imperial Forest School at one of our Universities.

Studying the Kootenai River

Government Looking for Reclamation Projects in this Section of the Country

MR. W. W. SCHLECHT, Assistant Engineer of the Reclamation Service, recently made a reconnaissance trip along the Kootenai River between Crossport, Idaho, and Nelson, B. C., in order to determine the practicability of reclaiming about 30,000 acres of land between Crossport and the International boundary line, which are flooded during the high stage of the Kootenai River. This high water stage usually lasts until the latter part of June, at which time the season is too far advanced to raise any of the indigenous fruits and vegetables, and only wild grass for hay can be raised.

At Crossport and above this point the stream is torrential and the banks are high and precipitous, but below Crossport it is sluggish and meanders through a valley averaging two miles in width. Mr. Schlecht reports that this valley is a typical flood plain, the banks being from 5 to 15 feet higher than the major part of the land lying farther back, but they are crevassed in many places and are very pervious, thus giving the water during the high stages of the river free access to the lower land.

Between Crossport and Kootenai Lake there is but one large tributary, which empties into the river in Can-

ada, but there are at least twelve small tributaries, which discharge considerable water during the high stages of the Kootenai. Considering the pervious nature of the soil and the numerous streams which would also have to be dyked, it is not believed that dyking the banks is feasible or practicable.

The fall of the river between Bonners' Ferry and Lake Kootenai is not over 10 feet, while the difference in elevation of Lake Kootenai between high and low stages is at least 25 feet, therefore enlarging or straightening the channel of the river would not improve matters, because it is considered that the stage of the lake is the chief controlling factor governing the stage of the river. As Kootenai Lake has an area of at least 40 square miles and rises 25 feet each year in spite of the fact that it has a continuous outflow, a storage reservoir above Bonners' Ferry would have to hold at least 500,000 acre-feet in order to reduce the high stage of the lake 10 or

15 feet, and a reservoir of this capacity would probably flood as much land as it is intended to reclaim.

There are two other possible ways of relieving this valley of its excess of water, but in both cases the regulating would have to be done in Canada. There are between 20,000 and 30,000 acres of land in Canada north of Porthill, Idaho, which would also be reclaimed. One plan is to divert the excess water through a canal into the Columbia, providing the lands along the latter river would not be damaged thereby, and the other is to enlarge the outlet of Lake Kootenai below Nelson. Further investigation in Canada, however, would be necessary in order to determine the practicability of these schemes. While it will be necessary in some way to lower the water in the lake from 12 to 15 feet, yet some controlling structure would probably have to be put in below Nelson in order to prevent the lake from falling to a stage which would hinder navigation.

Forest Fires

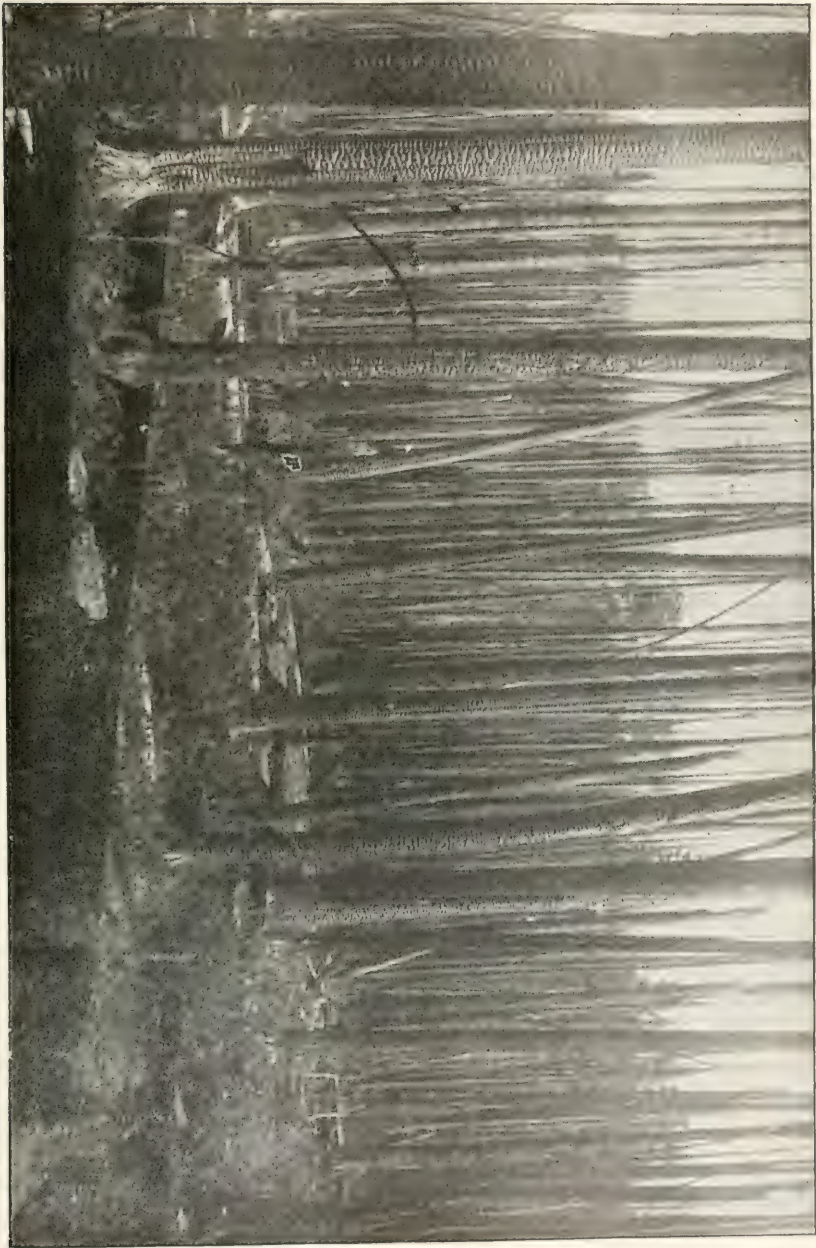
Record of Fires During the Month of October

Damage in any considerable amount from forest fires during the month just past has been principally confined to Montana, although California has suffered some loss. Soaking rains have effectually quenched the disastrous fires in Oregon and Washington, which have done immense damage for over a month. Several small fires are reported in Eastern States, owing to an unusually dry autumnal season.

Montana: A change of wind fanned a smoldering blaze in Warm Springs Canon into life and swept it in a destructive pathway toward the Twin Lakes country. This occurred about the middle of September, and at about the same time as another blaze west of Anaconda, which traveled eastward along the mountain side.

Despite a rainfall which extinguished most of the fires in the Bitter Root Forest Reserve mentioned in the last number of FORESTRY AND IRRIGATION, on September 29 a forest fire was reported as inflicting damage; in one case burning clear a strip of land ten miles long and a quarter of a mile wide in one night. Game was driven from the forests, and in many cases burned, in forest fires in the Clearwater country, and the Lo Lo district has suffered similarly.

California: Near Rainbow, on Eddy Mountain, a forest fire which started on September 22 was checked in its northernly course by Wagon Creek after consuming several acres of valuable timber land. Power plants and much valuable timber land was threat-



Burnt White Pine Forest, Priest River Forest Reserve in Idaho. Destruction Total.

ened by a large fire in Cajon Pass, which was started by a careless smoker and fanned into destructiveness by a fierce wind. A loss estimated at over \$5,000 was entailed by the loss of the Governmental Forestry Experiment Station in Santa Monica Canon. This same fire was the cause of considerable apprehension to the residents of Santa Monica, owing to its close proximity, and some outlying property was laid waste. In Butte County, near Stirling City, a forest fire did considerable damage over an area of timberland owned by the Diamond Match Company. In the vicinity of Escondido, flames swept up Aliso Canon and raged in the hills south of Bernardo.

Oregon: Timber men who have visited Columbia County, report that the forest fires which have been devastating that section for the last six weeks have caused the destruction of timber worth \$8,000,000. Very little damage has been done by the fire during the last thirty days, a much-needed rain having extinguished those still burning. On October 4 a forest fire in Grant's Pass was reported to have gained headway, but it is not thought to be of serious consequence.

New Jersey: A forest fire broke out in the heavy pine timber belt between May's Landing and English Creek on October 11, and a blaze of considerable magnitude was reported on October 29, in the Blue Ridge Mountains, 20 miles east of Wind Gap. Newspapers state that the latter fire burned over 10,000 acres.

Georgia: An area of about two hundred acres was laid waste by a forest fire just beyond Kinder Lou, which started from an engine spark.

West Virginia: The long-continued drought in this State has rendered woodland very inflammable, and on October 18 a forest fire not over a mile from Parkersburg caused considerable apprehension to residents.

Pennsylvania: An engine spark ignited the grass and undergrowth in bottom land near Newcastle Junction on October 3 and inflicted minor damage to timber.

Washington: Small fires in Pierce, Pacific, and Thurston counties are reported. In the last named it is claimed that the blaze was started by a man who set a fire without a permit, and was fined for the offense.

Reclamation Survey of Nebraska

A Study of its Water and Land Resources by the Government Engineers

A RECONNAISSANCE survey on the Niobrara and Snake rivers in Nebraska was recently made by Mr. J. C. Stevens, Assistant Engineer in the U. S. Reclamation Service, the purpose of the survey being to determine approximately the fall of these rivers, obtain gaugings of the rivers at frequent intervals, and of their principal tributaries, and to note and examine any reclamation project which might present itself.

The country traversed embraced the lands lying contiguous to the Niobrara

River between the 24th and 45th range lines, in townships 30 to 34, inclusive, and the lands contiguous to the Snake River in townships 31 and 32, range 30, and township 30 in ranges 31 and 32, also a territory known as the Lake Country, in townships 30, 31, 32, 33, and 34, ranges 23, 24, 25, 26, and 27, covering a total distance of 351.6 miles.

NIOBRARA RIVER.

The drainage area of this river consists largely of sand hills, resulting in a marked constancy in the flow of

this stream and its tributaries. These sand hills cover the larger part of ten counties, and are of little value except as range land, ten or fifteen acres being required to pasture one cow. Here and there are found valleys, or "hay-flats," usually running east and west, on which are cut quantities of wild hay. The soil is not susceptible of cultivation, because as soon as it is broken it begins to blow. The "sand blows" often cover several acres from which the sand is frequently blown out to a depth of twenty feet. Throughout the entire length of the river these sand hills are the characteristic feature of its drainage areas, sometimes bordering on the very banks of the stream, and sometimes receding several miles, between which and the river there is found a strip of rolling land of firm soil, and susceptible of a high degree of cultivation. However, the rainfall is insufficient to insure good crops, and the lands are too rolling to admit of practical irrigation, even if it were possible to get water on the land. On the upper Niobrara these areas of tillable land are of very great extent on the north side of the river, beginning several miles back.

The Niobrara River almost throughout its entire length runs in a deep canon from 20 to 400 feet deep. This canon has undoubtedly been cut by the river itself through the magnesia or "chalk rock" strata, which are very characteristic of this part of the country, making a firm, fertile soil, where it has not been encroached upon by the sand hills.

IRRIGABLE LANDS.

The only lands within the limits of this survey susceptible of practical irrigation are found in narrow strips along the banks in the bottom of its canons, and are seldom found in tracts exceeding 100 acres. The problem of irrigation here is a very simple one, but there is a lack of irrigation except on the upper Niobrara, where a number of ditches are in successful operation. Boiling Springs, Conly,

and Missouri Flats, the only level lands outside the canon, contain a combined area of about 15,000 acres, but they are so high above the bed of the river that gravity irrigation from that source is out of the question.

Aside from a limited number of irrigation ditches on the upper Niobrara and a few small mills, this river is put to no practical use whatever.

SNAKE RIVER.

This river is a tributary of the Niobrara and is in nearly all respects its counterpart. The canon near its mouth is about 350 feet deep, having been cut by the stream through magnesia or chalk formations, characteristic of the country. In Sec. 4, T. 31, R. 30, are found a series of falls from 5 to 14 feet high, above which the water surface is about 50 feet below the surrounding country. There are no irrigable lands contiguous to the lower Snake; nothing but sand hills, so that its development in this connection is out of the question. Power could be developed at little expense if it could be utilized.

THE LAKE COUNTRY.

This territory embraces a strip of country some 10 or 15 miles on both sides of the seventh standard parallel in Cherry County, and may be considered simply as a series of hay flats whose bottoms are below the general water table of the country. These "lakes" are said to have periodic rises, and a gauge was established on Red Deer Lake in order to determine the extent of these fluctuations.

Beyond the territory covered by this survey, that is, east of the 25th range line, through Rock and Brown counties, are found large areas of level, irrigable land. This land is so high above the river bed that water could only be put on it with difficulty, but there is an abundant water supply and irrigable areas to the extent of probably 500 square miles, and it is possible that a reconnaissance survey would develop some probable project for irrigating this land.

Foresters and Inspectors Wanted for the Philippine Forestry Bureau

The salaries of Foresters, Assistant Foresters Inspectors, and Assistant Inspectors range from \$1,200 to \$2,400 per year. Actual and necessary traveling expenses to and from the scene of field work are allowed, and while in the field one dollar gold per day is allowed for subsistence.

There are a number of vacancies in the different grades, and good men are urgently needed for this interesting and important work.

The work of the Foresters is, to a large extent, technical; that of the Inspectors more administrative and less technical.

Examinations will be held in different parts of the United States about July 1 and November 1. For detailed information apply to the Bureau of Forestry, Washington, D. C., or to the Bureau of Insular Affairs, War Department Washington, D. C.

Foresters and Inspectors now in the Philippine forest service and having from two to three and a half years' service, find the work very attractive, instructive and healthful.

Copies of the Philippine Civil Service Manual may be obtained from the Bureau of Insular Affairs, War Department, Washington, D. C.

The reports, bulletins and other applications of the Philippine Forestry Bureau should be read by all desiring to enter the service. Copies may be obtained by addressing the Forestry Bureau, Manila, P. I.

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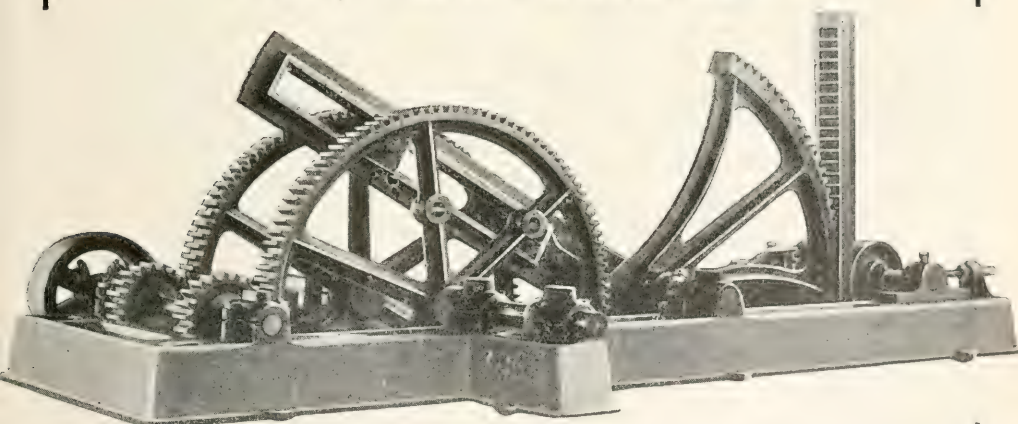
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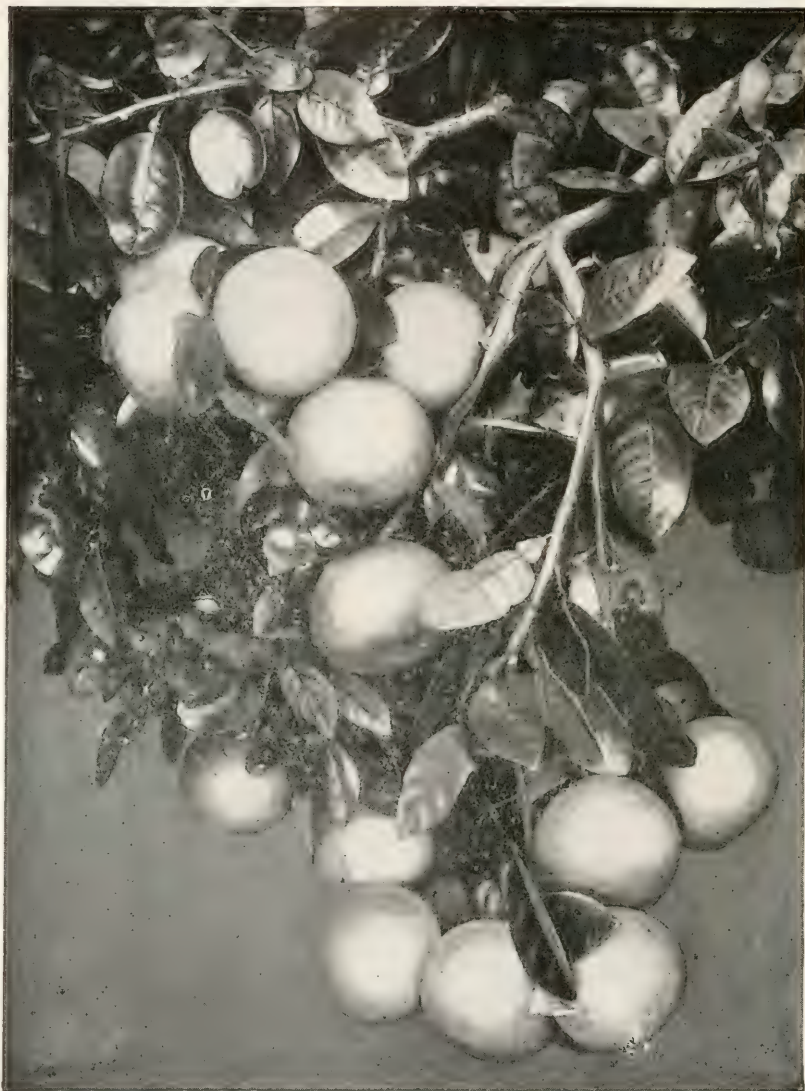
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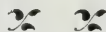
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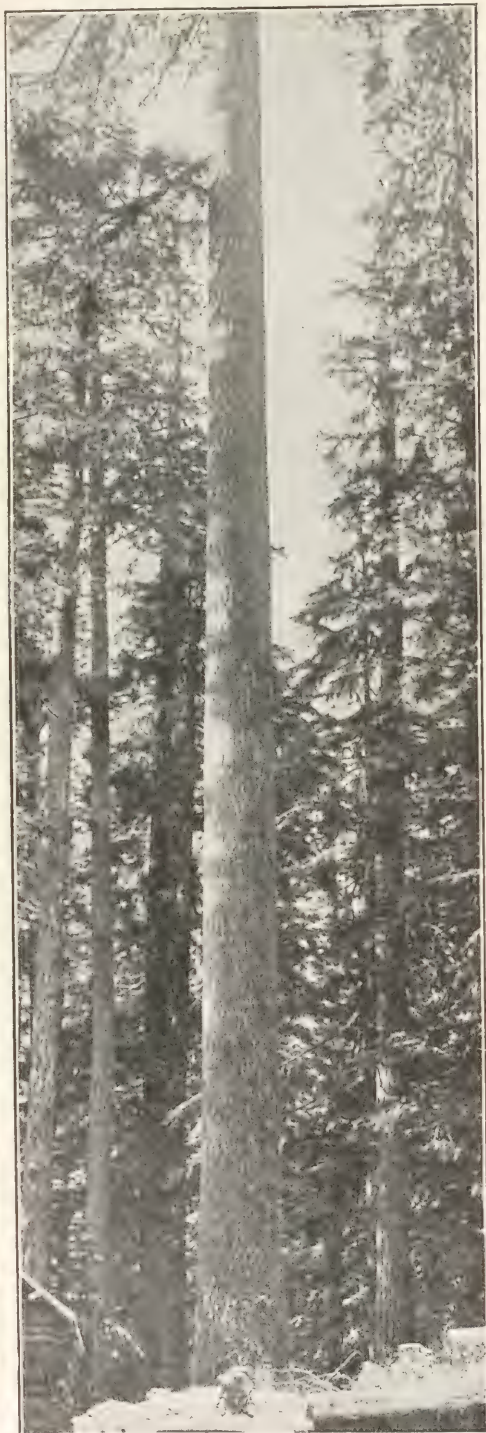


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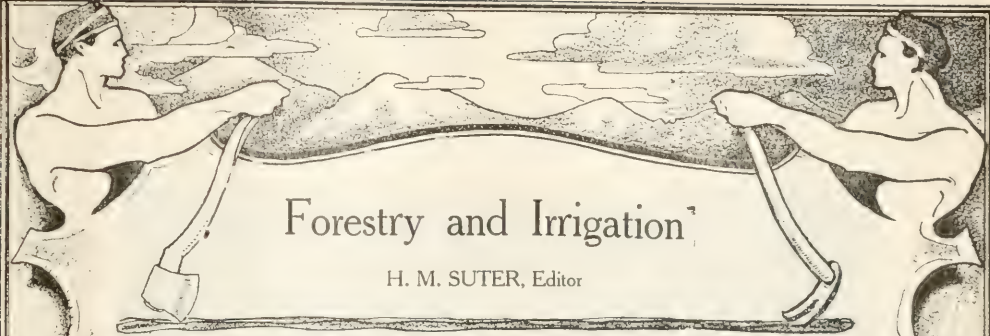
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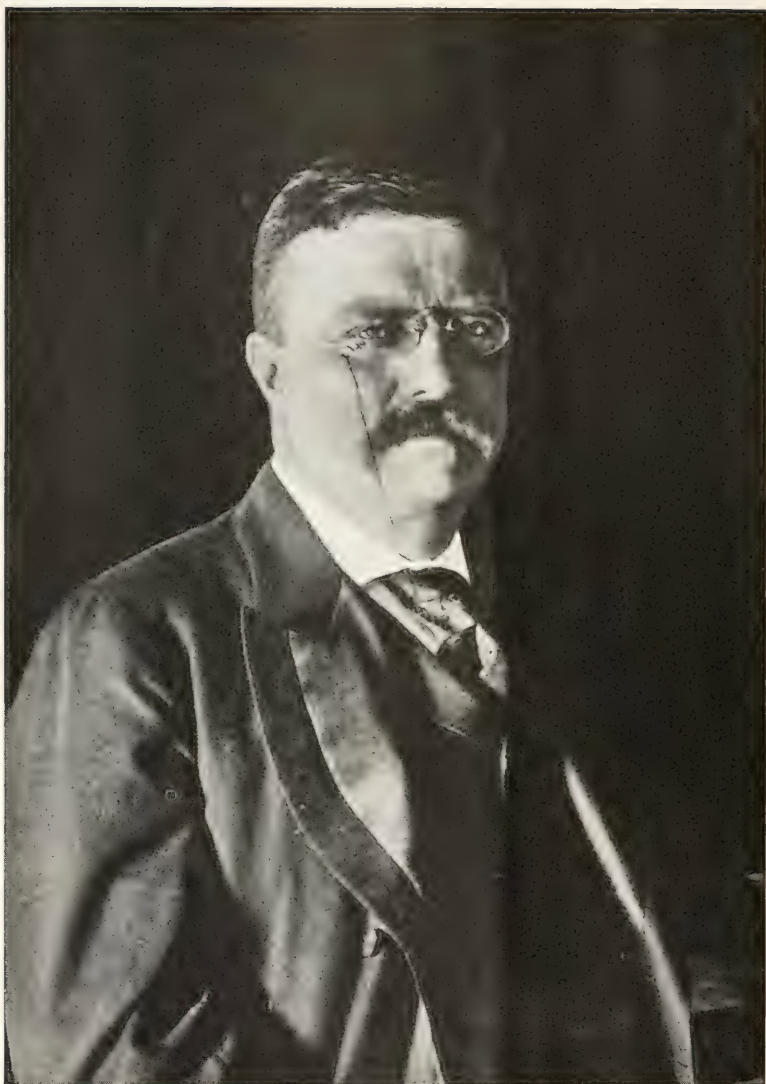
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AMERICAN FOREST CONGRESS

Arrangements About Completed for What Promises to be a Most Notable Gathering of Men Prominent in the Industrial Life of the United States

Persons desiring additional information in regard to the American Forest Congress should write to Committee of Arrangements, Atlantic Building, Washington, D. C., Wm. L. Hall, Chairman. The Committee is prepared to secure hotel accommodations, look after transportation arrangements and other matters in connection with the Congress.

The American Forest Congress at Washington, D. C., January 2-6, will be the most notable meeting that has yet been held in this country to consider the subject of forestry. Further, it will probably go down as one of the most important gatherings devoted to an economic question. From information already received by the committee of arrangements, a large and decidedly representative attendance is assured from every section of the United States. As evidence of this, at the time of going to press on this number of FORESTRY AND IRRIGATION (December 15), the governors of twenty-one states had already appointed delegates, and twenty-four of the leading railroads of the country had promised to send official representatives, the number including the presidents of twelve of the most important roads.

These include Mr. J. J. Hill, of the Great Northern Railroad; Mr. Howard Elliott, Northern Pacific; Mr. B. L. Winchell, Rock Island; Mr. Geo. W. Stevens, the Chesapeake and Ohio; Mr. Samuel Spencer, the Southern Railway; Mr. Russell Harding, the Pere Marquette; Mr. L. E. Johnson,

Norfolk and Western; Mr. Colgate Hoyt, Missouri, Kansas and Texas; Mr. Marvin Hughitt, Chicago and Northwestern Railroad. In addition a number of other high officials of foremost railroads will be present.

Telegraph and telephone companies will also have able representatives present. The lumber interests will probably be more largely represented than any other. Each lumbermen's association has the privilege of appointing five delegates, and a long list is already on file in the office of the secretary of the committee of arrangements. Among the prominent lumbermen who will attend are: N. W. McLeod, President National Lumber Manufacturing Association; Fred Weyerhaeuser, of St. Paul; R. A. Long, President Southern Lumber Manufacturers' Association; and the following presidents of leading lumber companies; Garret Schenck, of New York; Col. Geo. H. Emerson, of Hoquaim, Wash., and John L. Kaul, of Birmingham, Ala. Most of the lumber trade journals will be represented by their editors. The grazing interests will be represented by a number of very influential men from the Western States, among them F. J. Hagenbarth, president of the National Live Stock Association; Jesse M. Smith, president of the Utah Woolgrowers' Association; H. A. Jastro, president of the Kern County (Cal.) Cattle Growers' Association, and E. S. Gosney, president of the Arizona Woolgrow-

ers' Association. No less than eight supervisors of forest reserves will be present to participate in the discussions on the reserves. The mining interests will be represented by such men as John Hays Hammond and T. J. Grier.

Among the governors who have expressed their intention of attending the congress are Governor Cummins, of Iowa; Governor Peabody, of Colorado, and Governor Otero, of New Mexico.

At this writing the governors of twenty-one states have appointed delegates and promises from nearly all remaining states have been made.

State forest officials and foresters in private work will be at the congress. The faculty and students of the forest schools will also be present.

The American Lumberman, one of the leading trade journals of the United States, comments thus on the congress:

"There will be born at this meeting, or at some subsequent meeting which circumstances will compel the holding of at no distant time, a forest policy to be enforced in all parts of this country which will materially change existing methods and insure that perpetuation of the lumber industry and the conservation of other interests which must be instrumental in advancing the general welfare."

The first meeting of the congress will be at noon, January 2, to attend in a body the President's New Year's reception.

The four business days of this congress are each divided into two sessions, morning and afternoon, all except the session on Thursday afternoon, to be held in the National Rifles Armory, 920 G street northwest.

The program as given here is only tentative, but will give a general idea of the matters to be considered by the congress.

TUESDAY, JANUARY 3.

MORNING SESSION.

The morning of Tuesday, January 3, will be devoted to organization, to Secretary Wilson's address as president of the congress, to the appoint-

ment of committees, reading of the annual report of the directors of the American Forestry Association, and brief impromptu addresses by prominent men.

AFTERNOON SESSION.

This meeting will be devoted entirely to the "Importance of the Public Forest Lands to Irrigation." The irrigation question will be treated by those in charge of the Government's reclamation work, and by representatives of the vast agricultural interests so absolutely dependent upon irrigation for existence.

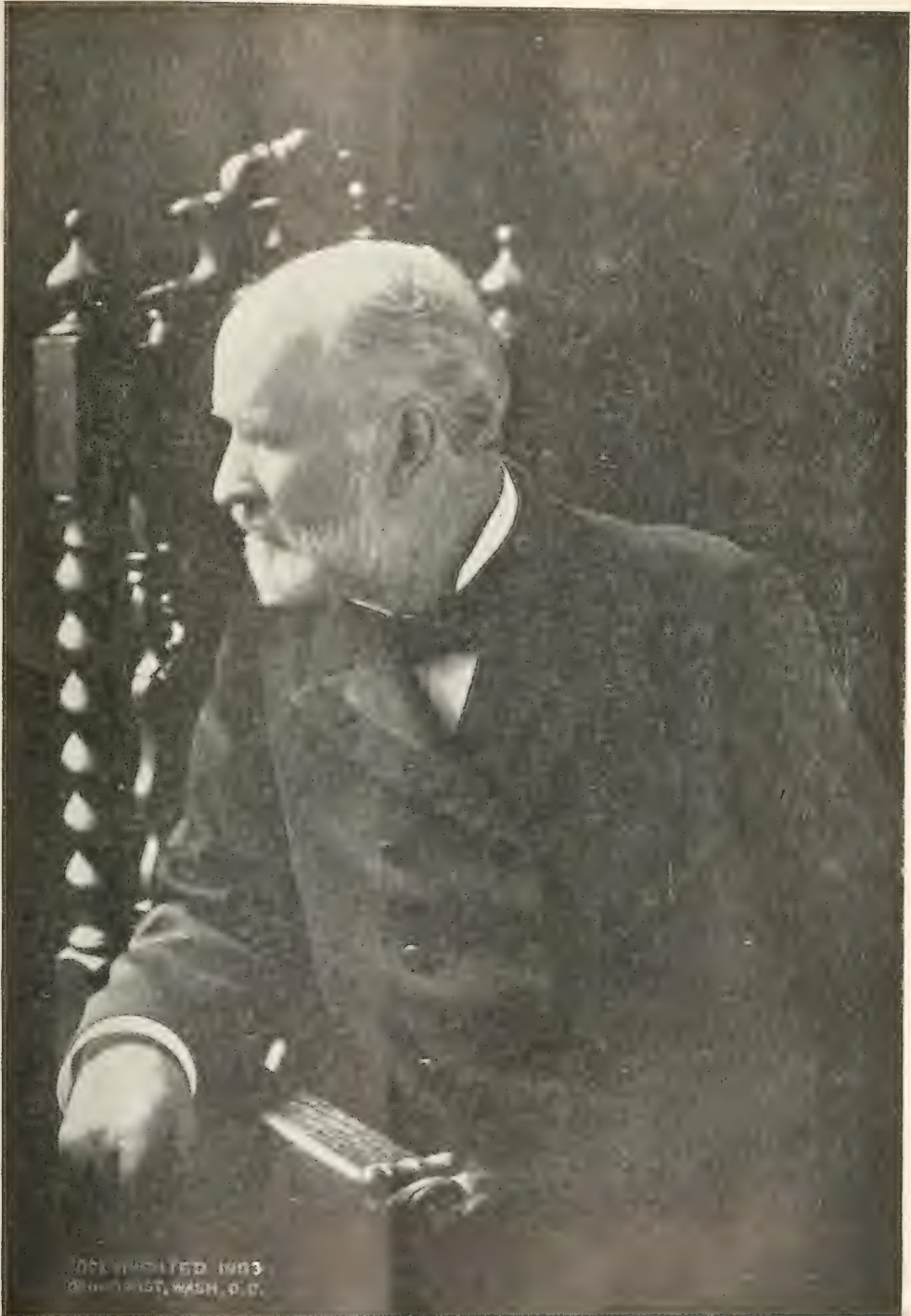
The speakers at this session will include: Mr. B. A. Fowler, President of the Salt River (Arizona) Water Users' Association; Mr. F. H. Newell, chief engineer of the United States Reclamation service; Mr. Guy E. Mitchell, secretary of the National Irrigation Association; Mr. Arthur P. Davis, Mr. J. B. Lippincott, Mr. Morris Bien, and Mr. C. C. Babb of the Reclamation Service, and Representative Frank Mondell, of Wyoming.

WEDNESDAY, JANUARY 4.

MORNING SESSION.

This entire session will be given over to the discussion of "The Lumber Industry and the Forests." Prominent lumbermen, editors of lumber trade journals, representatives of woodworking industries, and those having extensive practical experience in forestry will read papers. This session of the congress will be of exceptional interest and value. Many questions of great practical and economic importance have already been presented for consideration.

Some of the topics selected and the probable speakers are: "Changed Attitude of Lumbermen Toward Forestry," Mr. J. E. Defebaugh, editor *The American Lumberman*; "Interest of the Lumber Trade in Conservative Forestry," F. E. Weyerhaeuser; "How Far is Forestry Practicable on Lands of the Pulp Companies?" Garret Schenck, president Great Northern Paper Company; "Is Forestry Practicable in the Northeast?" John A. Dix, president Morse River Lumber



HON. JAMES WILSON,

Secretary U. S. Department of Agriculture, President of the American Forestry Association, and
Presiding Officer of the American Forest Congress.

Company; "Is Forestry Practicable in the Northwest?" Victor H. Beckman, editor *Pacific Lumber Trade Journal*; "Importance of Forestry to Woodworking Industries;" "Our Pacific Coast Forests and Lumbering as Differing from Other Forests," Col. George P. Emerson; "Rise in Value of Stumpage," R. A. Long, president Southern Lumber Manufacturers' Association; "Opportunities for Lumbering in the Philippines," Capt. Geo. P. Ahern, chief of Forestry Bureau at Manila.

AFTERNOON MEETING.

In the afternoon the "Importance of the Public Forest Lands to Grazing" will be discussed. Presidents of Live Stock Associations, men of large experience in grazing, and those who have made a special study of grazing in the forest reserves will address the congress. The program for this session as far as arranged at the time of going to press is as follows:

"The Demand of the Grazing Interests for the Use of the Reserves in Wyoming," Senator Francis E. Warren, of Wyoming; "The Range Question in Utah," Senator Reed Smoot; "Practical Results of the Regulation of Grazing in the Forest Reserves," Mr. A. F. Potter, Bureau of Forestry; "Sheep Grazing in the Reserves, from a Layman's Standpoint," Prof. L. H. Pammel, Ames, Iowa; "The Protection of Home Builders in the Regulation of Grazing on the Forest Reserves," E. S. Gosney, president Arizona Woolgrowers' Association, Flagstaff, Ariz.

Mr. Geo. H. Maxwell, executive chairman of the National Irrigation Association, will address this session.

THURSDAY, JANUARY 5.

MORNING SESSION.

Thursday morning the congress will consider "Forestry in Relation to Railroad Supplies." The presidents and engineers of some of the largest railroads in the United States will be the chief speakers at this session. They will discuss the tremendous demands of the railroads upon the forests for ties and other timber and consider means of solving this increasingly serious problem. Officials of the Bureau

of Forestry will tell what is being done in the way of extending the life of timber by preservative treatment.

The subjects of some of the addresses at this session are: "The Use of Timber by Railroads; Will It Increase or Decline?" "Progress in the Treatment of Ties to Prolong Durability;" "What Information Is Most Needed by Railroads in Regard to Timber Resources?" "Is It Practicable for Railroads to Hold in Reserve Timber Lands for Future Supplies?"

There will be a notable list of speakers at this session, including Mr. Jas. J. Hill, Mr. Marvin Hughitt, Mr. Howard Elliott, Mr. Thos. Cooper, Dr. Hermann von Schrenk, Mr. Eberlein, Mr. C. E. Wantland, Mr. Kruttschnitt, Mr. Bangs, Mr. Barclay, Thos. L. Hodge, Mr. Cushing, Mr. B. L. Winchell, Mr. Samuel Spencer, Gen. Chas. F. Manderson.

THURSDAY AFTERNOON.

Thursday afternoon there will be a popular meeting at the Lafayette Theater, admission by ticket. President Roosevelt, M. Jusserand, the French Ambassador; United States Senators and Representatives especially conversant with forestry, leading railroad men, lumbermen, and grazing men, and others prominent in national life will address this meeting.

The program as now outlined for this meeting includes the following addresses: "The Forest in the Life of a Nation," President Theodore Roosevelt; "The Forest Policy of France," Ambassador Jusserand; "Dependence of the Business Interests Upon the Forests," Howard Elliott, president of Northern Pacific Railroad; "The Interest of Congress in Forestry," Redfield Proctor, United States Senator from Vermont; "The Lumbering Interests and the Forests," R. L. McCormack, secretary Weyerhaeuser Lumber Company; "The Forest, a Resource of the South," F. McL. Simmons, United States Senator from North Carolina; "Attitude of Educational Institutions Toward Forestry," B. L. Wiggins, vice chancellor University of the South; "Importance of the Forest in



MR. GIFFORD PINCHOT,
Forester, U. S. Department of Agriculture.

Irrigation," Thomas R. Bard, United States Senator from California; "The Railroads and the Forests," J. J. Hill, president Great Northern Railroad; "The Use of the Public Forest Lands by the Live Stock Interests," F. J. Hagenbarth, president National Live Stock Association.

John Lamb, Member of Congress from Virginia, will also speak.

FRIDAY, JANUARY 6.

MORNING SESSION.

"The Importance of Public Forest Lands to Mining" will be discussed. The application and influence of present land laws will be considered, and the use of the forests in mining will be handled by the foremost American students of this question.

The subjects and some of the speakers are: "Misuse of the Timber and Stone Act;" "The Development of Water Power as related to Forest Reserves," Mr. A. L. Fellows, United States Reclamation Service; "Importance of Timber Supply in Mine Development in the West," John Hays Hammond; "The Effect of Mineral Land Laws on the Use of the Forests," John Thomas Burke, Seattle, Wash.; "Will the Administration of the Forest Reserves on a Conservative Basis Retard the Development of Mining?" Seth Bullock, supervisor, Black Hills

Forest Reserve; "How the Forest Reserves Help Mining," T. J. Grier, superintendent Homestake Mining Company, South Dakota.

AFTERNOON SESSION.

Friday afternoon the subject of "National and State Forest Policy" will be taken up. The officials of the General Land Office, the Geological Survey, and the Bureau of Forestry will open this question, which is of as far-reaching importance as any question which will come before the congress.

The leading subjects and speakers for this meeting are: "Work of the Bureau of Forestry," Overton W. Price, associate forester; "Work of the Geological Survey in Mapping the Reserves," Charles D. Walcott, director, United States Geological Survey; "Work of the General Land Office in the Administration of the Reserves," W. A. Richards, commissioner; "A Federal Forest Service," Gifford Pinchot, forester, United States Department of Agriculture; "Progress in Forest Reservation in Pennsylvania," Robert S. Conklin, Commissioner of Forestry; "Proposed System of Fire Protection in California," E. A. Sterling, Bureau of Forestry; "What is the Most Equitable System of Forest Taxation?" Hon. Charles W. Garfield.

AMERICAN FORESTRY ASSOCIATION

Annual Business Meeting Held at Washington, D. C., Dec. 14

The regular annual meeting of the American Forestry Association for the transaction of general business and the election of officers was held at the Atlantic Building, Washington, D. C., Wednesday, December 14. In the absence of President Wilson, Mr. Gifford Pinchot presided. The reports of Mr. Edward A. Bowers, secretary, and Mr. Otto Luebker, treasurer, were laid before the association. It was decided that the report of the board of directors should be read at the opening session of the American Forest Congress in January.

The election of officers resulted as

follows: President, Hon. James Wilson; vice president, Mr. James W. Pinchot; directors, James Wilson, F. H. Newell, Edward A. Bowers, Gifford Pinchot, Otto Luebker, George K. Smith, William S. Harvey, George P. Whittlesly, Henry S. Graves, B. E. Fernow, and William L. Hall. Corresponding secretary, H. M. Suter; recording secretary, Edward A. Bowers; treasurer, Otto Luebker. The list of state vice presidents elected will be published in the January number of FORESTRY AND IRRIGATION, along with the reports of the board of directors and the treasurer.



SENATOR THOS. R. BARD,
Of California, Chairman of the Senate Committee on Irrigation.



CAPT. GEORGE P. AHERN,
Chief, Forestry Bureau of Philippine Islands.

NEWS AND NOTES.



Mr. F. H. Newell, Chief Engineer, U S. Reclamation Service, who has rendered notable service to forestry in this country.

**Agricultural
Course at
Biltmore**

The Biltmore Forest School has enlarged its scope by adding to the courses offered a series of lectures on agriculture, delivered by Mr. Malcom Ross, assistant to the Chief of the Biltmore Farms. In connection with the course, the students will have a chance to acquaint themselves with the farming operations conducted on the Biltmore Estate.

**Steam
Gauging in
South Dakota**

The following stream-gauging stations were closed December 1, 1904, on account of unreliability of records taken during freezing weather, to be reopened March 1, 1905: Grand River at Siem, South Dakota; Moreau River at Bixby, Little Missouri River at Camp Creek, Little Missouri River at Alzada, Montana, Box Elder Creek at Black Hawk, South

Dakota; Spring Creek at Blari's Ranch, White River at Interior, Red Water Canal at Minnesela.

On account of their importance, the following streams will be kept up through the winter, if possible: Belle Fourche River at Belle Fourche, South

Hydrographic
Work in
South

In compliance with the request of Congressman Candler, who is deeply interested in the development of the natural resources of his district, the United States Geological Survey is extending its topograph-



Mr. Thomas F. Walsh, President of the National Irrigation Association, who has a deep interest in the forests of the West.

Dakota; Red Water River at Belle Fourche, Cheyenne River at Edgemont, Rapid River at Rapid City.

The expenditures during the quarter ending September 30, 1904, were \$592.40, and during the present quarter will be \$350. During the coming quarter \$100 will be needed.

ic work to embrace the region adjacent to the Tombigbee River both in Alabama and Mississippi, and is giving special attention to the cement rock and other mineral resources of that district.

As the water supply is of interest in connection with navigation, Mr. M.

R. Hall, who is in charge of the hydrographic work in that area, has been directed to investigate the conditions at Epes Landing, Alabama, and to establish a gaging station at that point if conditions are favorable. A gaging station is now maintained by the Survey at Columbus, Miss., while

**National
Park
Notes**

The report of Captain George F. Hamilton, Ninth Cavalry, superintendent of Sequoia and General Grant national parks, was made public today. He recommends that the Government acquire the ownership of every foot of patented lands in both



Hon. Redfield Proctor, United States Senator from Vermont, and Chairman of the Senate Committee on Agriculture and Forestry.

two stations are located on the Black Warrior above Demopolis.

It is believed that the data obtained by these geologic and hydrographic surveys of the year will furnish information of great value to those interested in the development of that region.

parks, and also of that part of Mineral King road within the limits of Sequoia Park. There is a group of twenty particularly fine Sequoia trees on the patented land near Sierra Camp which Captain Hamilton urges should be acquired by the Government without delay.

Captain Hamilton reports that the present system of guarding the parks by a military force is unsatisfactory and expensive. He recommends that the park be placed under the control of a permanent superintendent and six rangers. The soldiers are changed every year and have no interest in the park, with which they cannot become

Owens
Valley
California

Citizens of Owens Valley owning approximately 10,000 acres of land, have joined in a petition to the Secretary of the Interior, asking that the investigations and surveys now under way in the valley be continued and prosecuted by the Reclamation Service with all possible dis-



Mr. George H. Maxwell, Executive Chairman of the National Irrigation Association, and a staunch advocate of forest preservation.

acquainted in the short time they are stationed there. It is recommended that three townships east of Sequoia Park be transferred from the forest reserve to the park, as the country is the breeding grounds for game. Telephones should, in Captain Hamilton's opinion, be installed at convenient points for fire-fighting purposes.

patch consistent with economy, until decision can be made as to the feasibility of a project in that region. The citizens agree to heartily co-operate with the Reclamation Service and to make a proper and just adjustment of existing rights, conceding all that is consistent with equity and fairness in order to make the project a success.

The Reclamation Service will push the surveys and examinations as rapidly as possible in view of all the conditions, and it is hoped that a feasible project can be worked out and constructed at an early date.



New
Supervising
Engineer

Mr. H. N. Savage, of the United States Reclamation Service, recently has been made supervising engineer for Montana and Northern Wyoming, including the entire drainage basin of the Yellowstone River.

Mr. Savage is a graduate of the New Hampshire College of Agriculture and Mechanical Arts, and of the Thayer School of Civil Engineering, and since 1888 has served in the capacity of engineer, designing and directing construction works for various corporations, notably the Hydraulic Mining and Irrigation Company in New Mexico; National City and Otay Railroad Company, California; San Diego, Pacific Beach, and Lo Jolla Railroad Company, and San Diego, Cuyamaca and Eastern Railroad Company; Semi-transcontinental Railway from El Paso, Texas, to the Pacific Coast; Otero Irrigation District; construction, repairs and additions, increasing capacity of Sweetwater dam; and as Material Contractor's engineer for United States Government jetty under construction at entrance of San Diego Bay. On August 1, 1903, he was appointed consulting engineer in the Reclamation Service.



A Try for
Graff

The leading papers in the East lately have been giving considerable space to exposing a conspiracy which is alleged to exist and which has for its purpose the proposition to take the great national work of irrigation out of the hands of experts and make it a political job. It is pointed out that the politicians in the West have only just awakened to the fact that the reclamation fund is a very juicy sort of a pie and that they over-

looked a good thing, indeed, when they passed a law which practically made the Secretary of the Interior sole distributor of these millions. They are beginning to see wonderful possibilities in this fund, and at the next session of Congress it is said will introduce bills to curtail the power which the Secretary now enjoys, and open the way to the disbursement of this great fund in a manner more acceptable to the politicians whose eyes are now cast so longingly upon it.

How will the idea of a political engineer in charge of the work and a political commission distributing the fund strike the people of Montana, for example? What are this state's prospects should such legislation be enacted?

Up to date this state has contributed \$1,759,000. The opportunities for irrigation development in the state are so numerous and inviting that on two projects alone the sum set aside by the Secretary exceeds by several hundred thousand dollars the entire amount contributed by the state. Conditions are the same in Arizona, California, Colorado, Idaho, Nebraska, Nevada, New Mexico, South Dakota, Utah, and Wyoming, in which states and territories the requirements of the works projected are in excess of the funds contributed by them. The exceptions are North Dakota, Oregon, Washington, and Oklahoma, wherein the funds received exceed the cost of the proposed works. In two of these states—Oregon and Washington—projects are now being investigated which, it is believed, will require larger amounts than their contributions. There remain then but two—North Dakota and Oklahoma—wherein the prospects are not good for the early disbursement of the full sum received from the sale of public lands in each. Both Oklahoma and North Dakota lie partly in the humid and semi-arid belts. Over a large portion of each irrigation is not essential to agriculture, and in some years, notably the past four, irrigation has been quite unnecessary in North Dakota. It can readily be

seen that any legislative enactment which would require the expenditure of several millions of dollars in that state or in Oklahoma on irrigation works would surely result in failure. The works would lie idle six years out of every ten, the ditches would fall into disrepair, and the farmers would refuse to bear the burden of maintenance. Meanwhile feasible projects in sections in which irrigation is absolutely necessary for the production of crops would be held up and the material development of some of the most valuable and productive areas in the arid country would be checked for many years.

Of course there is no necessity for becoming unduly alarmed over the situation as long as President Roosevelt is at the helm. His knowledge of the question of irrigation is so broad, his familiarity with the semi-arid regions is so intimate, and his opposition to anything like political graft is so well understood, that he can be counted upon to nip in the bud any and all such onslaughts on the irrigation law, a measure in which his interest is particularly deep and abiding.



Water- Power in South Carolina

The Fifth Congressional District of South Carolina, which includes the counties of Cherokee, York, Chesterfield, Fairfield, Lancaster, Chester, and Kershaw, is rich in undeveloped natural resources, and the attention of capital is being directed toward that section. All information concerning the potentials of this region is eagerly sought for.

Congressman Finley in a letter to the Geological Survey has called attention to the splendid opportunities for water power development afforded by the Fifth District, which he represents. He thinks that not less than 200,000 horsepower can be developed on its numerous streams, and urges that more detailed information concerning the flow of the streams and topography of their drainage areas is

essential. He requests that an investigation be made of the water power of Broad River between Alston, Fairfield County, South Carolina, and the North Carolina line, and a like investigation of the power of the Catawba and Wateree rivers between Camden, South Carolina, and the North Carolina line.

The Hydrographic Branch of the Geological Survey is engaged in collecting data on this important subject, and is giving particular attention to several portions of the Fifth District. Gaging stations are now being maintained on Broad River at Alston, on the Cawtawba and Wateree rivers near Camden, South Carolina, Catawba, South Carolina, and at Morgantown, North Carolina. A profile of Cawtawba River has been made for a short portion in North Carolina, extending from Marion to Connellys Springs.

Appreciating the value and importance of the river surveys, the hydrographers will extend their work next season to cover the important valleys in this district.



Artesian Water a Fertilizer

Investigations carried on during the last year by Mr. S. W. McCallie, Assistant State Geologist of Georgia, acting in co-operation with the United States Geological Survey, have revealed the presence of interesting and perhaps valuable properties in some of the artesian waters in the Coastal Plain of that state. Water taken from a deep well at Baxley showed on analysis 5.5 parts per 1,000,000 of phosphoric acid, which would indicate that it might be used for fertilizing as well as for irrigating barren fields. In other words, it may be acceptable to the desert land as both food and drink. It is estimated that a layer of this phosphoric acid-bearing water 12 inches deep over one acre of land would exert a fertilizing effect equal to that of 200 pounds of commercial fertilizer.

RELATION OF FORESTS TO IRRIGATION

BY

GIFFORD PINCHOT

Forester, U. S. Department of Agriculture

THE National Reclamation Act, whose passage was directly due to the personal interest and effort of the President, is of a broader national character than many people in the East realized at the time. It will give to those portions of the country which it does not directly touch far more than the effect of that general reflex action which the prosperity of any part of the United States must have upon every other. In this case there are specific reasons, and of these the greatest is this: That the development of the arid West through irrigation will be of unmeasured importance to the East by the creation of more and greater home markets, for it is by home markets first of all that our people prosper. The Reclamation Act is a national benefaction whose blessing falls first and most plentifully upon the West, but which does not fail to bless any portion of the Union.

One of the fundamental facts which nearly every man here knows to his own cost is that there is more irrigable land in that prosperous country we used to know as the great American Desert than there is water to irrigate it. Water is the measure of the value of land, and it is water that the West needs. Every addition to the water supply will extend the irrigated area. When all the water now available has been put to use (and in many regions that time has either already arrived, or will not be long delayed), every deduction from the water supply will reduce the possible irrigable area. It is of the highest importance, therefore, not only to have a water supply but to keep it.

No argument is needed before this Congress to prove that forests con-

serve the water supply and vastly increase its usefulness for the purposes of irrigation. They do so by reducing evaporation, by regulating and sustaining the flow of streams, and by helping the snow water to get into the ground by seepage instead of into the air by evaporation. The forest is the first and most important factor in the water supply of the West, except the water itself.

In the West the forest does not now occupy nearly all the area suited for its growth. Doubtless every man here is familiar with denuded slopes dotted with the charred remnants of forests which have been destroyed, and with great stretches of open land, as to which there is no apparent reason why they should not be covered with trees. The fact is fire has driven the forest from vast areas upon which it should naturally flourish, and to which it may be restored by natural seeding or by extensive plantations. But it is not only the area of the forests which is reduced by fire. Very many forests are traversed by fire year after year and yet not destroyed. But no forest can be burned without suffering in what is to you its most important function—its capacity to store fallen rain.

The protection of the forest protects the present supply of water. In many places continued and effective protection will largely increase the steady flow of water in the streams, because many forests are now in poor condition. But this is only half the story. If the forests now standing are valuable for water supply then new forests created on water sheds now denuded will also be valuable. Here lies the possibility of increasing the irriga-

*A Idress delivered before Twelfth National Irrigation Congress at El Paso, Texas, Nov. 15-18, 1904.

ble area by increasing the water supply.

We know already that forest plantations on the open plains of the central West are taking on the character of natural forests, are reproducing themselves from seed, and are even extending their own boundaries. Forest planting in the irrigable mountain States is still too young to afford such examples, but the efforts of nature to cover again the denuded slopes furnish ample proof of what can be done.

The importance of all this lies in the fact that the extension of the forest on denuded water sheds will unquestionably be accompanied by an increase in the available water supply. I might cite case after case from older countries to sustain this contention, cases of springs restored and streams sustained by the renewal of the forest. We have begun planting too recently to prove it here, but unquestionably man after man in this audience could furnish proof of the converse proposition, that the destruction of the forest reduces the water supply. It stands to reason that if we restore the one

we restore the other. Forest fires then not only restrict the forest area, but they restrict the irrigable area as well.

What is the remedy for this age-long attack on the irrigable West by forest fires? It is a triple one. First, extension of forest reserves over all mountain water sheds of streams used for irrigation; second, a national forest service to control the forest fires and destructive lumbering, which is often their cause and nearly always their confederate, and thirdly, tree planting on denuded areas in the forest reserves.

I hold with emphasis not only that it is the duty of the national government to extend the irrigable area by increasing the low water flow of streams through planting on denuded water sheds in the forest reserves, but I also believe firmly that we are about to undertake as a nation more extensive forest plantations than have ever been made elsewhere. There is a definite need which can be met only with the protection of existing forests and the planting of new ones, and it is not to be doubted that we shall meet it.

NEWS OF RECLAMATION SERVICE

What the Government Engineers are Doing in Discovering New Irrigation Projects, and the Work on Old Ones

Plans for New Mexico and Texas.

IT will be good news to the people living in the valley of the Rio Grande in southern New Mexico and across the line in Texas to learn that the engineers of the Reclamation Service have located one of the finest reservoir sites in the country on this stream.

The investigations of the engineers this season have resulted in the location of a splendid reservoir site at Elephant Butte, near Engle, New Mexico, and careful surveys have demonstrated its feasibility and capacity.

Supervising Engineer B. M. Hall has made plans and estimates of the cost of the Rio Grande project and submitted the same to the board of consulting engineers composed of Messrs. Davis and Sanders. The board has approved the preliminary plans and has recommended that final surveys and preparation of plans and estimates be continued.

The reservoir site will be 45 miles in length, and its capacity will be 2,000,000 acre-feet, or ample for the 180,000 acres of land to be supplied by it. The cost of the project, includ-

ing reservoir and all diversion works and canals above El Paso, is estimated at \$7,200,000, or \$40 per acre for the 180,000 acres of irrigable land in the valley. This is below the value of irrigated land in this section, and those best informed pronounce the project desirable at the price. The main item of cost is the dam, which will require 500,000 barrels of cement and a large amount of machinery, gates, etc., entailing a very heavy outlay for freight.

It is estimated that the dam will cost

feet wide. The spillway is located at a natural gap on the west side of the valley several miles above the dam, and about 175 feet above the level of the present river bed at dam site. It will have a length of 800 feet.

At a public meeting recently held in the valley a resolution was unanimously adopted declaring in favor of the project and urging Congress to pass legislation to enable lands in Texas to be benefited by this reservoir and contribute to its cost.



View of Elephant Butte, New Mexico.

approximately \$5,300,000. As projected the dam will be arched upstream and at six degrees curve, the up-stream edge of the crest having a radius of 955.4 feet. Its dimensions are as follows: Height of dam from bed rock foundation to top of parapet walls or crest, 255 feet; thickness at bottom, 180 feet; on top, 20 feet; length of crest, 1,150 feet; the roadway is 5 feet below the crest between parapet walls on each side and is 14

Oregon Irrigation Projects.

THE superabundant and certain sources of agricultural wealth yet lying dormant in that part of Oregon east of the Cascades are on the eve of being developed on a scale in keeping with their enormous extent. Within this vast region, comprising an area greater than several New England states, the agricultural development has been confined to isolated sections, which, by reason of their con-

tiguity to lofty mountains, receive sufficient rainfall, and to small areas adjacent to perennial streams, which are irrigated. Within that portion of the state of Oregon which is bordered on the west by the Cascades and which borders Idaho on the east, are millions of acres of fertile land waiting only the touch of water to blossom into fields of waving grain, alfalfa, and producing orchards.

Until the passage of the irrigation law Oregon had received but little attention from the Geological Survey. When that law took its place in the national statutes Oregon for the most part was *terra incognita* so far as related to any practical knowledge of the supply of water flowing in the streams, the feasible reservoir sites and physical conditions. As these data so essential to the inauguration of any large irrigation work were lacking they necessarily had to be obtained before definite plans could be formulated, all of which required time.

The field is so vast that to cover it with even a preliminary investigation in one or two seasons would have necessitated the employment of the entire field force of the service, which of course could not be thought of. Recognizing the importance of the situation and discerning in some degree the possibilities latent in this region, the Chief Engineer organized a large and efficient force of engineers and aids, and with as little delay as possible established permanent quarters in the state in charge of John T. Whistler, an engineer of experience and ability. The work has been crowded along as fast as possible, and notwithstanding the serious obstacles in the way of the engineers, Oregon's prospects for having one of the largest government projects under construction at an early date are fully as good as those of other states, concerning the hydrography of which the department was much better informed. The Malheur project, so far as the government is concerned, is ready for building at once. If all the land under it were the property of the Federal government construction

would be ordered this winter. Unfortunately the project is delayed by the complications which always arise when large areas of ceded land are included in these works. These lands, however, are necessary to the success of the project, as without them the *pro rata* cost per acre would be prohibitive. It is hoped before the winter is over all these lands will be included. The contracts will then be let for the actual construction of the work.

Extensive areas in Umatilla basin in Harney County and elsewhere have been withdrawn from entry pending more careful investigation of water supply. No effort is being spared to bring up to date all the data that will be required to enable the engineers to pass upon these projects intelligently.

In connection with his work this summer Engineer Whistler has furnished an interesting report of a trip through the interior of the state by way of Burns, Paisley, Summer Lake, Silver Lake, Bend, and Prineville, which was made for the purpose of investigating several possible irrigation projects. One of these contemplates the irrigation of an extensive tract of land north of Silver Lake, known as the Low Desert or Summer Lake Desert. The water supply is from the headwaters of Deschutes River, one of Oregon's most remarkable streams. The area involved is estimated at more than 200,000 acres and the lands are of exceptional character. The region is remote from the railroad, but the reclamation of such a large body of land would undoubtedly bring transportation facilities very quickly. A very careful investigation of this area will be made next spring.

The government engineers have discovered a feasible reservoir site on Chewaucan River which will store water for the irrigation of 50,000 acres of excellent land. There is apparently no question as to the sufficiency of the water supply, and the majority of land owners are urging the Reclamation Service to extend its investigations in this section. In this case, as in a number of others in Oregon, the govern-

ment is stopped from proceeding in the direction of actual construction by a Carey Act selection which is pending before the State Land Board, which includes a portion of the best lands, and which if allowed will make it inadvisable for the government to develop a project there.

The altitude of the Chewaucan region, while high, 4,400 to 4,800 feet, is yet adapted to the cultivation of fruits and garden vegetables of all descriptions, including grapes, peaches, apples, apricots, melons, etc. Two crops of alfalfa are raised on irrigated lands. This is due to the protection afforded the valley by the Rim Rock Mountains on the west.

Notes on the Minidoka Project.

THE Secretary of the Interior has authorized the purchase of the following described tracts of land, now in private ownership, which, it has been found, will be needed by the government under the Minidoka project, as they lie within the flood line of the reservoir of that project:

NE $\frac{1}{4}$ SE $\frac{1}{4}$, SW $\frac{1}{4}$ SW $\frac{1}{4}$, and Lots 1, 2, and 3, Sec. 17; N $\frac{1}{2}$ SW $\frac{1}{4}$, and Lots 1 and 2, Sec. 16; Lots 6 and 7, Sec. 19; Lot 5, Sec. 20; and Lot 5, Sec. 21, T. 9 S., R. 28 E., Boise Meridian, Idaho; also the SW $\frac{1}{4}$ SE $\frac{1}{4}$, and Lot 2, Sec. 8; and NE $\frac{1}{4}$ NE $\frac{1}{4}$, and Lots 5 and 6, Sec. 17, T. 9 S., R. 27 E., Boise Meridian, Idaho.

Considerable difficulty has been experienced in getting water for domestic use on the Minidoka lands on the north side of Snake River. Only one well has so far been put down to water. This is the one sunk by the Reclamation Service several weeks ago. This well was sunk to a depth of 88 feet, and now has 13 feet of water of excellent quality and an abundant supply.

Contractors engaged in grading the road through the Minidoka tract are using this water for several camps in the vicinity. Engineer Ross states that it is doubtful if many settlers will succeed in getting water before spring,

and recommends that several wells be sunk on the line of canal in order that these may be used by contractors and settlers.

This recommendation has received the favorable endorsement of the Chief Engineer, who has ordered well boring outfits to be shipped at once to Minidoka.

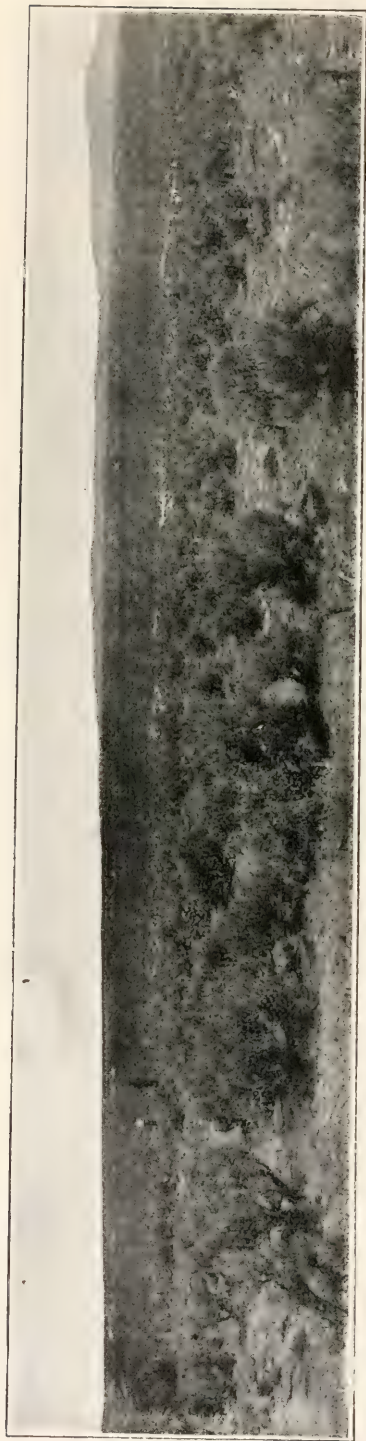
The Secretary of the Interior, acting upon the advice of the Assistant Attorney General, has decided that Mr. Nels J. Blagen has a right to be relieved from his bid for the construction of works in connection with the Minidoka project, Idaho, and is entitled to a return of his deposit of \$8,000 which accompanied his bid, he having declined to execute the contract awarded him. The return of the above sum to Mr. Blagen has been ordered by the Secretary.

The deposit was made by Mr. Blagen in compliance with the requirement of the advertised notice that each bid must be accompanied by a certified check for 2 per cent of the contract price as a guaranty. Mr. Blagen was awarded the contract, he being the lowest bidder, but declined to enter into it, and his deposit was held to be forfeited to the United States. The contract was then awarded to the next lowest bidder.

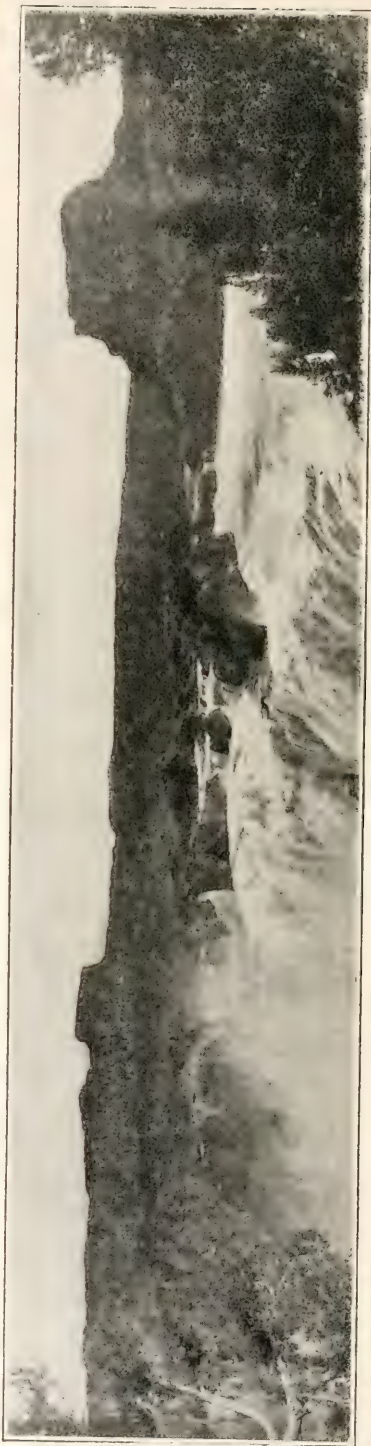
Mr. Blagen claimed that owing to a change in the specifications by the engineers after his bid was submitted the value of the contract was affected to such a material extent that the construction of the work could not be accomplished at the price bid without serious loss or diminution of profits. He contended that he was thereby released from obligation and entitled to a return of the deposit. In this contention he seems to have the approval of the Attorney General.

A Study of The Little Missouri River.

THE investigation of irrigation possibilities on the Little Missouri River, conducted by Engineer James A. French of the Reclamation Service, has been concluded. This in-



Lands to be Reclaimed by the Minidoka Project in Idaho.



Shoshone Falls, Idaho.

vestigation was undertaken primarily for the purpose of determining the feasibility of irrigating lands along the Little Missouri River near the southern border of North Dakota, and also to ascertain if it were possible to conduct the water from the stream to the headwaters of the Grand and Cannon Ball rivers, where large bodies of land are located susceptible of irrigating, providing a sufficient water supply could be obtained.

The Little Missouri River heads in Wyoming, and, flowing in a northeasterly direction, crosses the southeastern corner of the state of Montana; then entering the state of South Dakota, and thence into North Dakota, its course is northerly for 100 miles, where it turns abruptly to the east and empties into the Missouri River in Fort Berthold Indian reservation.

That part of the river through South Dakota for a distance of 30 miles flows in a flat, rolling valley, the hills on either side being distant from one to five miles. The banks along the river are low, being from ten to thirty feet above the river bed. A large area of land recently has been withdrawn in this section pending further investigation by the engineers.

As the river flows to the north the valley narrows and the stream has cut banks of considerable height. The side streams coming in also increase in size proceeding down stream, so that when the Bad Lands are entered the cut banks are several hundred feet in height and the streams are twenty miles or more in length, necessitating wide detours for canal lines to head them. The small discharge that occurs during the period when water is required for the crops, June, July, and August, necessitates the storage of the waters of this stream. Owing to the low, flat country it passes through in Montana and South Dakota, there is no available reservoir. Storage would have to be provided at some point below the divides in Cannon Ball and Grand River drainages. The diversion selected was at a point twenty miles

south of the south boundary line of North Dakota, and four miles north of Ashcroft, South Dakota. The canal line would follow for fifteen miles through fairly good country for construction, with three or four exceptions where cut banks along the river would be encountered.

In the vicinity of the boundary between North and South Dakota the line would have to head several creeks that could not be crossed under an ordinary heavy fill. This condition increases rapidly descending the river, the creeks growing longer and the canyons deeper and wider, with side hills and cut banks of great height. In the case of Spring, Skull, Coyote, Seven, Five, Horse, and other creeks adjacent, it would be next to impossible to cross by flumes or siphons or by fills, owing to the great expense. To head them means ten miles or more of heavy work, with numerous culverts and heavy fills. Where these creeks cross the direct line of the canal they vary in depth from 50 to 200 feet, and from 1,000 to 4,000 feet in width. For each creek there is a corresponding cut bank from 50 to 100 feet in height and vertical cliffs from 400 to 1,000 feet or more in length. These would have to be gone through and cannot be avoided.

From below Spring Creek the river is in the Bad Lands and a simple inspection is sufficient to condemn any canal construction. There is no place along the Little Missouri River that comes under this investigation where there is a possibility of a dam being constructed to store the waters. There is no dam site, no reservoir of capacity, the river falling approximately eight feet in one mile with a narrow valley, making small area for storage. Any further investigation of the possibility of diverting the Little Missouri River in this vicinity would be an unnecessary expense, and a drive along the canal line that would have to be followed would be convincing of the enormous amount of work that would have to be done, particularly along this stream in North Dakota.

The shortest canal line that would divert the waters of the Little Missouri River into the Cannon Ball or Grand River drainage would be a length of more than 170 miles.

Ever since the enactment of the irrigation law the citizens of Helena, Mont., and in Prickly Pear Valley have been endeavoring to secure government aid in constructing an irrigation project to reclaim a large body of arable land. This matter has been one of special importance to the city, inasmuch as the growth of Helena has made the question of water supply a paramount one.

The irrigation of perhaps 100,000 acres lying right at the door of the city would add greatly to Helena's population and augment the business of her merchants and manufacturers immeasurably. Consequently a strong appeal has been made to the Reclamation Service to institute an investigation of the feasibility of an irrigation project in that locality.

One feature of the proposed project which has deterred the Government from proceeding actively in this matter is the fact that all the areas to be irrigated are in private ownership in large tracts, making the proposition more properly one for private capital to exploit. The question of water supply was known to be involved by reason of power developments, several companies having appropriated a large proportion of the normal supply. So many inviting projects were known to exist in the state, all of which were free from the complications which surrounded the Prickly Pear scheme, that an investigation of the latter was held in abeyance until others more attractive had been made.

In conformity with a promise by Chief Engineer Newell during his visit at Helena last summer, District Engineer Robbins was directed to detail an engineer to make a quick reconnaissance of the valley and submit a report. Mr. Robbins appointed Assistant Engineer Prendergast, and he has just concluded an investigation of the project.

Summarized, the report indicates that while the project is within the limits of practicability, it is not a highly favorable one, not being comparable with any one of the several other projects in the state which have been receiving the attention of the Government engineers.

As a source of water supply, Mr. Prendergast found the North Boulder Creek entirely inadequate, and the valley of the stream apparently contains no suitable storage site. One alternative of bringing water from the upper Jefferson is not deemed as feasible as utilizing the Madison River, for the reason that the canal lines would necessarily be of greater length and the country traversed much rougher and containing less irrigable land. Consideration was also given to a proposition to pump water from the Missouri River below the power house at Canyon Ferry, but the cost of power as quoted by the company was so great as to make this plan impracticable.

Another alternative is to develop power by damming the Missouri River and pumping water from that stream to irrigate lands farther down. The scheme involves many engineering questions, which must be considered before definite statements can be made as to its feasibility.

The Madison River project embraces 100,000 acres, one-half of which lies in Prickly Pear Valley, the remainder being scattered along the line between the Madison and Radersburg. This scheme involves the excavation of 131 miles of canals; a short tunnel, steel bridge across the river, and a masonry weir 300 feet long and 10 feet high, also an inverted siphon one-half mile long. The estimated cost is \$2,400,000. The canal will require 1,000 second-feet of water during the four irrigating months, and the diversion of this quantity would probably effect the flow of the Missouri at the power site and would result in litigation. It is probable that during the coming season the engineers will renew this investigation.

WORK OF YALE FOREST SCHOOL

Outline of Courses and Special Lectures to be Given During the Winter and Spring Terms

ARRANGEMENTS are being made for a special course of lectures to the Yale Forest School in January. The sessions of the American Forest Congress will be completed on Friday, January 6. The special lectures for the Yale students begin January 7, and continue until Friday noon, January 13. Arrangements have already been completed for lectures by the following men:

Gifford Pinchot, Forester United States Department of Agriculture, six lectures; Mr. F. H. Newell, Chief Engineer United States Reclamation Service, five lectures; Mr. F. V. Coville, Botanist United States Department of Agriculture; Mr. W. L. Hall, Mr. G. B. Sudworth, Mr. T. H. Sherrard, and Mr. F. E. Olmsted, all of the Bureau of Forestry, one lecture each.

It is expected that Capt. Geo. P. Ahern, Chief of the Forestry Bureau of the Philippines, Mr. A. F. Potter, Mr. Fred. Weyerhauser, and a number of others will give one or more lectures each.

The winter term at the Yale Forest School begins for both classes on Monday, January 16, and closes Saturday, April 8. The spring term for the Junior class begins Monday, April 17. Unless it is necessary to postpone the opening of the spring term a few days on account of the Civil Service examination, the Seniors will meet, ready for work, on Monday, April 17, in Milford, Pike County, Pa., where the entire work of the term will be conducted. The term will close June 21. The chief work of the first half of the term will be Forest Engineering with Professor Marston and Mr. Austin Gary in charge. During the first half, there will be courses also by Professor A. D. Hopkins, Dr. G. Hart Merriam, Mr. Henry Daly, Dr. B. W. Evermann, as described below. The last few

weeks of the term will be devoted to special work in connection with Forest Management. There will also be a special course of lectures on Forestry in India, Japan, Philippine Islands and the Territory of Hawaii by Professor Graves. Those who expect to enter the Philippine service will be given additional work on the Philippines during the last part of the term.

It has been announced that hereafter there will be a difference of \$500 per annum between the salaries of positions in the Philippines and corresponding positions in the United States Bureau of Forestry.

During the winter term the lectures in Forest Management and History of Forestry will be given by Dr. B. E. Fernow. Professor Graves will spend the winter in the Philippines, India, and the Territory of Hawaii. The purpose of this trip is to do certain inspection work for the United States Government, and to secure material for instruction about these countries. Professor Graves left December 3 and will return to Milford about May 15, 1905.

Arrangements have been made for the following courses:

"Forest Entomology," (4 to 6 lectures, spring term) Dr. A. D. Hopkins, United States Department of Agriculture. A course of special lectures dealing chiefly with field investigations in the injury to trees and forests by insects.

"Fish Culture," (12 lectures, spring term) Dr. B. W. Evermann, United States Bureau of Fisheries. Natural reproductions among fishes; artificial propagation of fishes; species propagated artificially in America; the care of fish fry; methods of shipment of eggs, fry, fingerlings and adults; how plants of fish are made, pollution of streams and lakes; fish protection; history of fish culture in America. These

lectures are supplemented by field excursions.

"Forest Zoology," Dr. C. H. Merriam, Chief United States Biological Survey. This course treats of the animal life found in the forest; classification and study of forest animals; game protection; work of the United States Biological Survey.

"Lumber Trade and Transportation," (6 to 8 lectures, winter term). Mr. C. I. Millard, Secretary Chicago Lumber and Coal Company. Recent development of the lumber trade in America; manufacturing and distributing centers; tendencies of the trade; problems of transportation of logs and lumber; relation of the lumber trade to transportation.

"Packing and Pack Transportation," (2 weeks, spring term) Mr. Henry Daly, Chief Packer, United States Army. This course includes lectures on the methods of packing; use of different types of pack saddles; different hitches for tying down the pack; selection of pack animals; care of animals. Each student is given practical work in packing horses and mules.

"Forestry in the Philippine Islands," (12 lectures, spring term) Professor Graves. Forestry regions of the Phil-

ippines; forest types; description of the most important trees; timber products; measurement of timber; logging and milling; markets and prices; Government administration and laws; duties of inspectors and other officers; timber permits; policy of Government in handling public forests. The course includes a discussion of the opportunities for foresters in the Philippines, character of a forester's life, and precautions necessary for health.

"American Studies of Forest Growth." During the winter term Mr. A. F. Hawes, State Forester of Connecticut, will meet the Senior class two hours a week for the discussion of studies of the growth, volume, and yield which have been made in the United States. Mr. Hawes has all the available tables of growth, including the unpublished results of the studies which have been made by the Bureau of Forestry. Mr. Hawes will interpret for the class these studies, and indicate the possible problems which may be solved by the studies already made. The use of this material in timber cruising, making working plans, and determining the value of forest lands, will be fully discussed.

IRRIGATION OF INDIAN LANDS

Reconnaissance of Proposed Ceded Strip of Shoshone Indian Reservation in Wyoming

BY

GOYNE DRUMMOND

THE proposed ceded strip of the Shoshone Indian Reservation, in Wyoming, comprises an area of approximately 2,283 square miles, extending eastward from the North Fork of Wind River, which marks the western boundary, to Big Horn River on the east, and northward from Big Wind River to Owl Creek. The irri-

gation area embraced within these bor-

ders is approximately 230,000 acres, and lies east of Crow Creek and between Big Wind River and Owl Creek Mountains. The greater portion of this land is rolling, but can be easily watered. The soil is a sandy loam, warm and fertile, covered with sage brush. Wheat, oats, rye, barley, alfalfa, potatoes and garden vegetables are grown very suc-

cessfully on portions of this strip, and there is no doubt as to the fertility of the soil when properly irrigated. The land being rolling and having a good drainage, very little of it will be injured from seepage water. Within this area are a number of sand rock buttes, ranging in size from one-half to 160 acres, and extending over the entire strip between Big Wind River and Muddy Creek. With the exception of that portion lying within the Big Bend of Big Wind River and comprising 20,000 acres, these buttes make it difficult to determine with any degree of accuracy the amount of irrigable land, and until a topographic map has been made only an approximation is possible. It is believed that the estimate of 230,000 acres, however, is a conservative one.

In the big bend of Big Wind River, extending north and west, are about 20,000 acres of fine bottom sage brush land sloping toward the north and east. North of Muddy Creek, a small stream flowing east through the irrigable land a distance of 20 miles and south to Owl Creek Mountains, are 40,000 acres of fine sage brush land with a slope to the east and south. Between the Big Wind River and Muddy Creek is the largest body of land, 190,000 acres. South and east of Popo Agie River are about 10,000 acres of rolling land sloping to the north and east, which, it is believed, will be difficult to water.

WATER SUPPLY.

The source of water supply is the Big Wind River and its tributaries, which have an approximate drainage area of 2,000 square miles. A measurement of this stream was made on October 19, 1904, at which time the headwaters had begun to freeze and its flow was retarded. The discharge was 406.3 second-feet. This measurement was made at a point about two miles above the mouth of Bull Lake Creek, and about seven miles below the point of diversion of the proposed canal.

In the event that the water supply should prove insufficient to irrigate the land without storage reservoirs, there are three reservoir sites above the head of the upper canal which have a combined capacity of 121,000 acre-feet. These are in three lakes: Brooks Lake, 25,000 acre-feet; Troy Lake, 26,000 acre-feet, and Dinwoody Lake, 70,000 acre-feet. The last mentioned lake is in the diminished strip of the Shoshone Indian Reservation, but cannot be used for storing water for Indian lands, nor will its use in any way be of damage to the Indians if utilized for storing water for the proposed ceded strip. If water is stored in it, it will not flood any grazing land, as the surface area will be increased but little. Dinwoody Creek flows from this lake and measurements taken on August 29, 1904, show that it had a discharge of 425.6 second-feet. Bull Lake is on the diminished strip and a dam 50 feet high, which could be constructed at little cost, will store 120,000 acre-feet. Bull Lake Creek was measured on August 22, 1904, when it had a discharge of 498.9 second-feet. A portion of the water of this reservoir might be used for watering about 20,000 acres of the diminished strip, but as the bluffs along the river are very high and broken the cost would be probably \$30 per acre. This reservoir will not in any way damage the Indian lands should it be necessary to use it for storage purposes.

That portion of the land lying south and east of Popo Agie River will probably have to be irrigated from stored water, and there are numerous lakes on this stream in the mountains which may be utilized for this purpose. Shoshone Lake on the South Fork of the North Fork of the Popo Agie River has a capacity of 10,000 acre-feet with a forty-foot dam across its outlet, and the volume of water would be ample to fill it as the headwaters of this stream are in a region which has a heavy snowfall. The Big Popo Agie River below its junction

with the Little Wind River, on August 17, 1904, had a discharge of 592.3 second-feet. The North Fork of Popo Agie River on August 31 had a discharge of 118.8 second-feet.

HIGH LINE CANAL.

A survey was made during the early part of July, 1904, of a high line canal. Its head is in the southwest corner of Sec. 7, T.4 N., R.3 W. Its source is in the Big Wind River and the waters stored in the Brooks, Troy and Dinwoody lakes can be utilized in this canal if necessary. The course of the canal is easterly, covering the entire strip of irrigable land north of Big Wind River. Its capacity is 1,300 second-feet; its width 50 feet on the bottom, and its slope 1 foot per mile.

The location of this canal line is on comparatively level ground, and it extends about 72 miles to cover 40,000 acres of land north of Muddy Creek. Laterals can be constructed from the canal to cover all the land, but it is believed that other canal lines can be taken out at a less cost than the laterals, and owing to the fact that the fall of the country is too great for the slope for canals, it will be necessary to build a number of drops in them.

On the high line canal are three drops; the first at a point 36 miles from the head, has a drop of 86 feet; the second 37 miles, a drop of 55 feet; and the third at 48 miles, a drop of 60 feet. These drops are necessary in order to avoid heavy rock side hill work, but very little land will be lost by them.

Another canal line is proposed in order to avoid carrying the water so far in canals. This is taken from the Big Wind River in Sec.36, T.3 N., R.1 W., and has very little side hill work. The low line is taken out of Big Wind River in Sec.32, T.2 N.,

R.2 E. This is also on good ground for construction, with very little hill work and ground of a character to maintain a canal.

LAND ON DIMINISHED STRIP.

Between Little Wind and Popo Agie rivers are about 60,000 acres of irrigable land, which will have to be watered from these streams. Storage will be required. These streams for a portion of the irrigation season have water enough, and if the present system of farming by the Indians were continued, will always have enough, but if all the irrigable land is once under cultivation the normal flow of the streams will be inadequate for late irrigating.

At the mouth of the South Fork in Little Wind River Canyon there is storage for about 16,000 acre-feet, and above the falls are numerous lakes which will doubtless afford storage for all the flood waters required. Meadow Creek, one of the lesser tributaries, has flow sufficient to irrigate about 10,000 acres, and it is thought that this area of irrigable land can be found adjacent to it. The stream, however, sinks in a cave near the mouth of the canyon, and in order to utilize the water it will be necessary to construct a canal 2,000 feet long through a limestone ledge carrying the stream around the point where it sinks, and turning it into the channel below, where it could then be taken out on the land.

On the Big Horn River at the mouth of the canyon in Owl Creek Mountains is the only reservoir site on this stream. Its capacity cannot be determined until a detailed survey has been made. In Sheep Mountain Canyon on Big Horn River is a good site for a dam, but the valley is narrow and the area covered by the water small, so that it is not thought practicable for a reservoir site.



PRIVATE RIGHTS IN FOREST RESERVES

What They Are and How They Were Affected
By the Establishment of the Forest Reserves

THE National Mining Congress at its session held at Portland, Oreg., August 22-25, adopted resolutions favoring "the conservative use of forest resources, and in particular the creation and management of forest reserves under practical, business-like rules and regulations." Early in August the National Live Stock Association, at its Denver meeting, was equally earnest for practical control and improvement of forest areas.

The permanent prosperity of nearly all the far Western States is threatened by the destruction of the forests on the watersheds of irrigation streams. Wasteful lumbering, excessive grazing, and fires are unceasingly cutting down the efficiency of the forests as sources of water supply. Conditions are rapidly growing worse and this is evidenced by the constant demands of citizens for the creation of new forest reserves. The great difficulty is to determine boundaries which will include only lands suitable for the purpose, and will avoid injury to local enterprises. The interests of the settler, the cattle or sheep man, the miner, the lumberman, and the irrigator, often all dependent upon the same region, are always more or less conflicting. Seldom is a reserve created without opposition from one or more of these interests. Commonly the practice of the Government is to withdraw from settlement all the land involved until it can be carefully examined, after which the suitable portion is included in a permanent reserve, and that which proves to be open, agricultural, or largely under private ownership, is released.

A settler who has entered upon a claim which is later included in a forest reserve does not thereby lose it. He may return to the Government and in lieu thereof select another equal

portion of the public domain. Or, if he elects to remain on the claim, he is protected in all his rights of ownership, is allowed free ingress and egress over reserve lands, and is also permitted, without cost, to cut reserve wood for domestic and farm repair purposes. Residents in the neighborhood of reserves are granted a similar free use of wood.

Omitting actual settlers, four classes of citizens are directly and specially interested in reserves. Lumbermen, stock grazers, and miners are concerned with the forest as a producer of timber and grass. Farmers have their direct interest in the highest water conserving power of the forests. It is not impossible so to adjust the claims of these four classes as to provide for them all. Each of the first three can so use the forests as not to injure the rights of the others, and can at the same time so conduct their several industries that the value of the forest in regulating stream flow will not be diminished. Indeed, under proper management it will actually be increased.

No authority exists for selling the timber standing on unreserved public lands. Its free use is being greatly abused, leads to numerous frauds, and has become an additional reason for reserve establishment for forest protection, as well as for the passage of a law permitting the sale of such timber. Lumbermen can buy this timber only by buying the land outright, and the law limits to 160 acres the size of the tract any one purchaser may secure. After the establishment of a reserve, however, the timber can be bought in large or small quantities. The cutting, removing, and clearing must be done under contract with the Government, according to a definite plan, and with strict regard for the

best welfare of the forest. Moreover the land, which remains in the Government's hands, is kept productive, instead of going to waste after lumbering as is too often the case when it falls to private ownership.

The vast public domain of the West has been given up to the stock business for pasturage in common. The forests, forming a part of this domain, have been subject to this unrestricted pasturage. The result has been disastrous to the domain both open and forested, but the forests have suffered the most injury. Restricting forest grazing by means of reserve regulations and inspection will eliminate the danger from overgrazing, will ultimately greatly benefit the business, and will, most important of all, enable the forests to perform their highest function for all the people. A few grazers may have their rights slightly abridged or more closely regulated, but the business as a whole is conducted in a more orderly way.

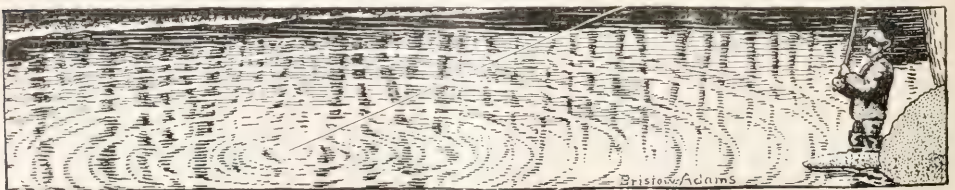
Prospecting and mine development are not at all restricted by reserve establishment. Miners require in their work both timber and water. Their demand for timber is comparatively not great, and they cut it somewhat more carefully than lumbermen have done. Their interests do not suffer in the least by forest reserve establishment. On the contrary, in the long run they will be greatly benefitted by the protection which assures their future timber supply.

The greatest industry affected by forest reserves is farming. In many parts of the West it depends absolutely on the water flow from the forest. If ill usage impairs its storage capacity, and the stream flow, in consequence, alternates between flood and drought, or is permanently lessened, all

the dependent farm land suffers severely. Every farmer has the right to insist that his water supply be not decreased, and the industry as a whole, the foundation stone of our national prosperity, commands and will receive the highest protection it is possible for the Government to afford. Irrigation for the arid West can not be successful unless the headwaters of all streams are kept under ample forest cover.

Reserves are for use, not for ornament. They are not private forest parks, but are open to all persons without distinction. Free transit across them is always allowed. Pleasure or health seekers and hunting parties are privileged to enter them at all times and enjoy their resources to the fullest legal extent. The most important injunction laid on them is that the greatest care must be taken to extinguish all camp fires, since fire is the worst scourge of the forest, and of all its enemies the most dreaded.

The temporary withdrawal of lands pending a careful inspection to determine their suitability for permanent reserves affects seriously no private right other than that of entry as a settler upon some claim. No entry can be made after such temporary withdrawal. If lands settled upon are finally included in the permanent boundaries, the rights of the owners are as has been set forth. If such lands are excluded from the boundaries, their status has not been affected, except as it is improved by being so near a forest that will now be protected and managed for the general welfare. The whole theory of reserve practice is, special injury or advantage to none, but the greatest good to the greatest number.



FOREST FIRES OF THE PAST MONTH

Sixteen States Report Damage Done During the Month of November

THE past month has been remarkable in the number of forest fires at a time when the fire season is practically over. However, it is noticeable that those reported were mostly from the middle west, where drought has made favorable conditions for their start and spread. No large amount of damage has been done in any particular section, however.

Arkansas—This state probably suffered more, and with greater loss than any other state during the month just ended. A serious railroad collision occurred near Swifton, where forest fires had filled the air with dense smoke, along the line of the St. Louis and Iron Mountain Railroad. Near Eureka Springs, along the right of way of the same railroad, considerable damage was done to pine timber. A two-months' drought helped the spread of a blaze in the vicinity of Jonesboro, which devastated a number of acres. The whole eastern section of Arkansas suffered more or less from numerous small blazes, and at Paragould several buildings and a large amount of crops were consumed. Residents of the Blue Cane country were forced to fight threatening fires on November 18, and a timely rain on November 20 extinguished a fire which had been burning in Crittenden County and near Quigley and Proctor for some days.

Indiana—The country near Vincennes has been laid waste by a forest fire of considerable magnitude. A number of farm buildings, residences, and one store near Rockport, in Spencer County, were destroyed by a forest fire, which started on November 27. Children set fire to brush near Connersville, and before it could be checked, a number of acres of timberland were burned over. The college buildings at Hanover had a nar-

row escape from destruction by a forest fire, which suddenly assumed threatening proportions after smouldering for some time. Sixty acres of timber were devastated by a forest fire near Pendleton, in Madison County, on November 19.

Illinois—Near Havana, 1000 acres on the East Shore suffered damage from a forest fire on November 26, and on the other side of the river considerable loss occurred. Sweeping for seven miles a forest fire west of Mossville destroyed a large acreage of valuable timber, and required the united efforts of the farmers in that section to check its further course. On November 19 a number of forest fires were reported burning six miles west of Anna; and near Peoria in the Illinois bottom lands, seven square miles of land were devastated. Much valuable pine timber was lost in a blaze west of Alton Pass; and west of Chester, contiguous to Missouri, a number of conflagrations were reported on November 19.

Missouri—A St. Louis paper estimates that 2,000 acres of prairie and timberland were burned over in a fire near Chillicothe, but no great damage is said to have been done to the larger timber.

Kentucky—The hardwood timber of the state suffered in forest fires in McCracken and Marshall counties, and near Paducah a number of fires did considerable damage. Residents of South Park were forced to set a counter fire to check blazes which threatened large damage. Near the Harrison County line, forest fires gained headway on November 23, and after raging with considerable damage, were checked a week later. Near Carter, a fire burned for several days and spread over a large territory, inflicting considerable loss.

Ohio—A forest fire south of Bowling Green destroyed an abandoned nitroglycerine factory and a small storehouse, with considerable damage in the vicinity. Minor forest fires near College Hill, Cincinnati, were checked through the efforts of students from the Ohio Military Academy; and Scioto County suffered some damage through loss in timberlands and stock.

Indian Territory—In addition to large prairie fires in the Creek and Cherokee nations, forest fires did considerable damage on lands owned by the Ozark and Wauhatchie Clubs.

California—Only one fire of any appreciable magnitude caused loss in California, and this was one which swept up Los Flores Canyon, north of Altadena, on November 20. The press of this section deplors the loss of a large amount of timber, chiefly valuable in conserving the water supply; and laments the probable effect it will have on the irrigation water supply.

Montana—Towards the head of Big Casino Creek and at the head of Big Spring Creek, forest fires were prevalent on November 28. In the Boulder Creek region, west of Saint Mary's River, some damage was also occasioned.

Colorado—There was some loss through a fire in timber northwest of Mount Santias, up Two Mile Canyon.

Texas—A newspaper report of No-

vember 18 states that forest fires, accompanied with dense smoke, have been raging north and east of Colmesneil for several days. No great amount of damage has been done, however.

Kansas—At the military reservation near Leavensworth, a battalion of the Sixth Cavalry was detailed to extinguish several threatening fires south and west of the Post on November 20.

Pennsylvania—In the eastern part of the state some damage resulted from a forest fire near Monongahela, which started from a railroad engine spark on November 23. The manufacturing town of Axleton and the buildings surrounding the Mongah mine narrowly escaped destruction.

New Jersey—A newspaper report places the loss occasioned by a fire near Millville at \$12,000. The fire burned four days before it could be checked.

Virginia—An area of over twenty square miles was laid waste by a fire near Blacksburg on October 28, and a glaze near Norwood consumed quantities of cordwood and fence posts.

Tennessee—At least \$2,000 worth of timber and fence lumber is said to have been lost in a forest fire in Humphreys County. Obion County also suffered minor damage from forest fires in the woods near Redfoot Lake.

TWO HUGE PUMPING PROJECTS

Half a Million Dollars Set Aside by Federal Government to Reclaim Large Areas of Land in North Dakota With Water Pumped From Missouri River

THE Secretary of the Interior has formally set aside the sum of \$550,000, or as much thereof as may be necessary, from the Reclamation Fund for use in connection with the Buford-Trenton and Bismarck pumping projects in North Dakota. This approval is based upon the recommendations of the Reclamation Engineers

who have spent a part of the past summer investigating the feasibility of irrigating lands by means of water pumped from the Missouri River. The investigations were commenced about the middle of August by Mr. H. A. Storrs, electrical and mechanical expert, the intentions being to determine if it is feasible to irrigate a portion of

the state by pumping from the streams in the western part of the state, using lignite as a fuel.

A hasty reconnaissance of the state was made, the report of Prof. Frank A. Wilder of the North Dakota Geological Survey and maps of the Missouri River Commission were studied and field work then commenced, Mr. P. M. Churchill, engineer, being placed in charge. A party was organized at Williston about September 4, and has made preliminary surveys on the Bu-

distance between these two points by river is 300 miles. The average fall of the river is about eight inches per mile. Along the banks, especially the left, are large areas of low flats which are easily irrigable by pumping from the river. Their elevation above low water ranges from 20 to 35 feet. Back of these are bench lands ranging from 40 to 200 feet above the river.

Thus far it has not been deemed feasible to divert water from the river and distribute it by gravity to these



Fifteen Lignite Beds in Single Section of Little Missouri River, North Dakota.

ford-Trenton and Nesson flats, and will continue working at Williston until the season closes.

Near the last of September Mr. James A. French, assistant engineer, was directed to assist in this work with his party, and has spent the remainder of the season in field work in the vicinity of Bismarck. The field work of the present season has been devoted chiefly to certain localities on the banks of the Missouri River included between Fort Buford and Bismarck. The

flats, owing to the low gradient of the stream. Fortunately the local conditions are favorable to the use of stream pumping plants, it having been found that large tracts can be supplied by single plants with comparatively low lifts and short canals. The supply of water is abundant and fuel is cheap and plentiful.

The Buford-Trenton Project.

On the north side of the Missouri River a series of flats extend from the

Montana-North Dakota line to about four miles east of Williston, a total distance of 28 miles. The larger of these, that at Buford, extends from the state line eastward about nine miles and covers 18,000 acres, which is the extent of the Buford-Trenton project. The next flat, that at Trenton, is 15 miles long and contains 4,000 acres. The area of the Williston flat is undetermined, as it depends upon the height to which it is deemed advisable to raise the water. It may be roughly taken at 7,000 acres.

Of these the Buford-Trenton flat is the most important. From the river these flats extend north from two to four miles to where they meet the hills. At the base of these, runs the Great Northern Railway. These hills contain the local supply of lignite coal in veins from two and one-half to four feet thick. Several small creeks run onto the flats from the hills, and it is claimed by local residents that these will furnish water enough, if properly dammed, to supply the first irrigation. It is proposed to dam all of the creeks or coulees and store as much of their spring floods as possible, this water to be used for the first irrigation and to be distributed by gravity. The main supply, however, will be furnished by pumping. About two miles west of Buford railroad station there is a coulee called Garden Coulee. It is proposed to dam this at its mouth, and to erect the main pumping station just west of it and fill the reservoir thus formed by pumping into it with a 25-foot lift. As nearly three-fourths of the Buford flat is below this elevation, the low line canal for watering it can be taken out of this reservoir by gravity.

With some excavation the reservoir on Garden Coulee will allow the water to extend north for 2,000 feet to a point where a nearly vertical lift may be made of about 30 feet for an intermediate canal and 60 feet of high line canal. These canals will cover all the remaining land. They will also cover the flat east of Trenton, and if carried

on would cover nearly all of the Williston flat.

The Bismarck Project.

Commencing near the bridge of the Northern Pacific Railway just west of Bismarck and extending south along the east side of the Missouri River to the vicinity of Glencoe lies a series of flats covering 20,000 acres of land. By lifting water from the Missouri River 25 feet at the railway bridge and delivering it to a canal running along the upper or eastern part of these flats, this whole area may be covered. Above this lie another series of flats. These are somewhat rolling and their extent is indefinite, depending largely upon the lift to which it is economical to pump. The survey now being made indicates that a lift of 150 feet above low water in the river will cover all the area, including the city of Bismarck.

Surveys so far made indicate that an eighty-foot lift will cover most of the flat at Bismarck, will pass through the high divide southeast of Apple Creek at a point near Magnus, and will cover a large tract to the south, the area of which is yet to be determined. The same lift will carry water to McKenzie, where there is a large low meadow called McKenzie Slough. It is possible that the water may be run by gravity from here onto large flats south of Dawson, where a lift of 75 feet more would cover another large flat.

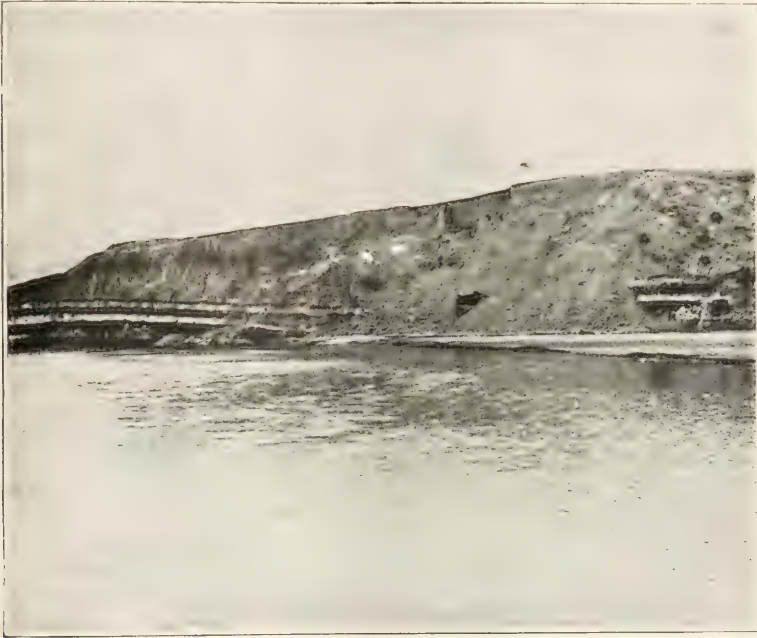
It is proposed to place a pumping plant about three-fourths of a mile below the Northern Pacific bridge at Bismarck, and there lift water for 15,000 acres into a main canal 25 feet above the river. This canal will follow the top contour of the first bench or bottoms, and from it water can be distributed over about 75,000 acres of bottom lands. At a point on this main canal about two miles below the main pumping plant an auxiliary plant with a lift of 25 feet will cover 7,000 acres, and one of 40 feet will cover an additional 1,000 acres.

An investigation will be made as to

power plant close to the coal supply, the feasibility of locating a central from which power can be transmitted electrically to the pumping plants. If this is found feasible it is probable that the irrigable area can be largely increased. The pumping plants are designed with a capacity equal to pumping the entire two-acre feet per acre in 80 days, providing the plant be operated at full capacity. With a full plant in operation the entire area could

cated at the coal mine the cost might be reduced to the mere expense of mining the fuel, say 60 to 70 cents per ton. It probably would require no more coal to do a certain amount of pumping on account of the better efficiency of the large steam electric units. The canal system has been estimated at \$5 per acre. This covers land irrigated and other extras.

There are no special difficulties to be encountered by this special system,



Four Coal Beds on Little Missouri River, Near Mikkelson, North Dakota.

be covered three inches deep in 10 days.

The cost of fuel for the Bismarck estimate is taken at \$2 per ton, delivered. This is believed to be high even if it has to be purchased in open market, since a yearly contract of from 5,000 to 10,000 tons would no doubt secure a price less than the usual market price. On the other hand, if the coal is secured from government land, the price would probably not exceed \$1.20 per ton for coal delivered at the pumping plants. In the event that a central electric generating plant be lo-

ated at the coal mine the cost might be reduced to the mere expense of mining the fuel, say 60 to 70 cents per ton. It probably would require no more coal to do a certain amount of pumping on account of the better efficiency of the large steam electric units. The canal system has been estimated at \$5 per acre. This covers land irrigated and other extras.

There are no special difficulties to be encountered by this special system,

as no coulees or railroads have to be crossed. The irrigable land is all in private ownership and mostly in 160-acre tracts or smaller holdings. The lands under this project are valued at about \$10 per acre. The lower bench is cultivated at the present time only to the extent of covering the native hay. On the upper bench wheat, corn, and vegetables are grown with some success. The project is favorably located, being on the outskirts of a city of some size and on lines of two systems of railroad. The preliminary estimates of cost of the Buford project,

based on an irrigation season of 100 days, with the duty of water two-acre-feet per acre, and the cost of coal \$2 per ton, is as follows:

For main pumping plant, including cost of buildings, machinery, piping and freight, \$72,000; auxiliary plant, \$29,750; boiler plant, engineers' salary and incidentals, \$18,950; suction and pressure pipes, intake and canal headworks and buildings, \$60,000; first cost of canal system, \$70,000; total for entire plant, \$250,700. The estimated cost of the annual operation, \$30,325, or \$2.02 per acre. The estimated first cost of the plant is \$16.71 per acre.

Since the Secretary has set aside the necessary amount for the construction

of these works, the next step will be for the land owners who are in possession of practically all of the irrigable land under these projects, to form water users' associations, providing for the collection and payment to the government of the cost of reclamation. Thus far in the progress of government work this step has been one of the most difficult. The government requires that the land owners shall pledge their lands as security for the return in ten annual installments without interest of the sums expended in the construction of these works. It is hoped that an organization will be effected this winter in order that the engineers may take up the work of actual construction early next season.

A NEW TIMBER SEASONING PROCESS

The Bureau of Forestry Will Soak Poles in Water
and Then Investigate Their Rate of Seasoning

THE Bureau of Forestry, at its new experiment stations in Wisconsin and Michigan, will make seasoning tests of cedar and tamarack telephone and telegraph poles which have been submerged in water for varying lengths of time. This is an entirely new line of experiment. That immersion in water seems to affect the rate of seasoning has often been noticed. Rafting is said by many lumbermen to improve timber, and logs which have lain for a long time in swamps are in some places eagerly sought for their superiority for certain uses. But just why this should be true, and what practical use can be made of the fact in seasoning generally, are matters which have never been thoroughly ascertained.

It is known that the sap of green wood contains certain soluble substances—albumen, starch, sugars, tannin, etc.,—which undoubtedly are leached out of timber immersed in water to a greater or less extent. In ordinary seasoning these substances are

left behind as the water evaporates and are deposited on the cell walls. As seasoning begins on the outside, these deposits must act as clogs which virtually bottle up to a certain degree the water in the interior. It is possible also that chemical or physical changes in the wood cells are produced by soaking.

Timber seasoning is at best tedious and slow work. It can be done fairly well in ten or twelve months, but thorough seasoning requires from eighteen to twenty-four months, the time varying with the different kinds of wood. If the Bureau of Forestry realizes its expectations from these new experiments, the time required for seasoning poles will be reduced one third, and possibly much more. This would prove an exceedingly valuable economy. If, in addition, the durability of the poles can be increased in this way, the saving both to users of poles and to the cause of forest preservation will be enormous. For every year added to the service of poles cuts off a pro-

portionate demand upon the forests for their renewal.

In these new tests the poles will be submerged in water for different periods, from one week up, to decide what length of time will give the best results. They will then be placed on skids about 2 feet above the ground and left to dry. They will touch each other, but will be laid only one layer deep. At the expiration of every thirty days each pole will be weighed, and also measured to ascertain any shrinkage of its circumference. Unsoaked poles have furnished a circumference shrinkage of one-sixteenth to one-eighth inch in thirty days, and of one-fourth inch in six months.

An important matter in seasoning is the loss of weight. Past experiments with white cedar poles have shown a loss in weight of about one-third after sixty days of drying. In the case of

chestnut poles the same length of time showed a 10 per cent. loss. These poles are long and very heavy, and such a large weight reduction means a decided saving in freight charges, and increased ease in handling. But this advantage, though important, is small in comparison with the gain in lengthened service. Further, with greater resistance to decay it will be possible to lower the present butt diameter requirement, which is now based on the certainty that rot will soon weaken the power of the pole to withstand strain at the surface of the ground. Altogether, if the soaking process fulfills what it seems to promise, it will have a notable bearing on one of the large branches of timber consumption, as a moment's thought of the number of poles in use in the entire country will show.

THE TWELFTH NATIONAL IRRIGATION CONGRESS

Held in El Paso, Texas, in November—Substantial Attendance—Text of Principal Resolutions

The last day's session of the Twelfth National Irrigation Congress at El Paso, on Friday, November 18, was when the actual business of the Congress was accomplished. The previous sessions on Tuesday, Wednesday and Thursday had been principally occupied in the discussions of certain varied phases of irrigation, carried on simultaneously in five sections, as follows: "Production by Irrigation," Mr. I. D. O'Donnell, chairman; "Engineering and Mechanics," Mr. F. H. Newell, chairman; "Forestry," Mr. Gifford Pinchot, chairman; "Climatology," Prof. H. E. Williams; "Rural Settlement," Mr. William E. Smythe, chairman.

This division into general heads, centered the discussions on each particular subject, and afforded those

desirous of taking part in the proceedings of the congress along special lines, to do so without entering into discussions in which they had no immediate interest.

A notable part was taken in the various sessions of the congress by Mr. Gifford Pinchot, Forester, United States Department of Agriculture; Mr. F. H. Newell, Chief Engineer of the United States Reclamation Survey; Gov. George C. Pardee, of California; and Mr. George H. Maxwell, Executive Chairman of the National Irrigation Association.

To those not present at the congress, the last day's proceedings, with the adoption of the resolutions of the congress, and definition of its policy in regard to general and special phases of irrigation, will probably appear most

interesting. The presence of government experts and eminent irrigation authorities throughout the country lent an authoritative tone to the proceedings. The afternoon session on Wednesday brought out some interesting figures in connection with the attendance—figures that eloquently express the interest in the entire country has in irrigation, and settlement of the arid and semi-arid west. A total of twenty-four states and territories were represented by 400 delegates; apportioned as follows: Arizona, 42; California, 37; Colorado, 12; District of Columbia, 11; Idaho, 6; Illinois, 5; Indian Territory, 1; Kansas, 3; Louisiana, 2; Michigan, 1; Minnesota, 7; Missouri, 4; Montana, 5; Nebraska, 12; Nevada, 4; New Mexico, 50; North Dakota, 1; Texas, 60; Utah, 26; Washington, 5; Wisconsin, 10; Mexico, 45; Egypt, 1.

The educational character of the discussions of the congress and the various papers, lectures, and speeches given is perhaps the most valuable aspect of the congress. The indorsement of the Federal Government's various irrigation projects is evidence of the keen interest and appreciation of the people at large in the workings of the Reclamation Law.

This congress did not mince matters on the public land question. It passed a resolution strongly urging the repeal of all land laws but the Homestead Act, and offering substitutes for the present acts, which is in marked contrast to the weak evasion of the issue at the Eleventh Irrigation Congress at Ogden, Utah, last year, in the adoption of the Needham resolution. Senator Clark, president of the congress, in his speech at the final session denounced the Needham resolution as a subterfuge and a trick to evade the issue.

The Elephant Butte project, at Elephant Butte, N. Mex., under examination by the United States Reclamation Service, for the erection of an irrigation system to reclaim lands of the Rio Grande Valley in New Mexico, Texas, and Mexico, received

the unanimous support of the congress. The Reclamation Service was commended for its "splendid and valuable services," particularly in its efforts to solve the vexatious problem of equal rights in water supply for New Mexico, Texas, and Mexico, by the erection of the Elephant Butte dam.

After two successive terms as president, Senator W. A. Clark is succeeded by Governor George C. Pardee, of California. The other officers elected were: First vice president, Judge L. M. Shurtliff, of Utah; second vice president, Congressman J. H. Stephens, of Texas; third vice president, E. L. Smith, of Hood River, Oregon. Portland, Oregon, was selected as the meeting place of the Thirteenth National Irrigation Congress.

The principal resolutions adopted by the Congress are as follows:

It is the opinion of the National Irrigation Congress that the National Irrigation Law be so extended by Congress as to include the State of Texas within its provisions in so far as to permit the Secretary of the Interior to direct engineers of the United States Reclamation Service to examine and report upon feasible irrigation projects, and when approved according to the terms of the said law, to superintend their construction to the end that Texas may have the benefit of the same service that is now extended to the other arid sections.

The appropriation of funds for forest planting on denuded watersheds in the forest reserves is essential to the progress of irrigation, and we strongly urge upon Congress legislation to that end that during the coming session with the view of increasing the value of streams still flowing and restoring those which have disappeared.

We express the fullest confidence in the honesty, ability, and capacity of the officials of the Reclamation, and Forest, and Weather Services, and commend their impartial and non-partisan administration; and our hearty thanks are hereby tendered to the officials of the Interior Department, and

the Department of Agriculture, who have so ably contributed to the success of this congress.

We heartily commend the work of the Weather Bureau in the preparation of the Climatological Dictionary now in progress, and we bespeak for this publication the widest possible publicity.

We repeat and emphasize the resolutions of the previous congresses in favor of the consolidation of all government forest work in the Department of Agriculture, owing to the peculiar fitness of that department for the work, and urge the immediate passage of the bill for this purpose now before Congress.

We indorse the policy of the Government in the construction of a ship canal along the west shores of the Sabine Lake in Southeast Texas, with the view of opening to navigation the Sabine and Naches rivers, which, in addition to opening the inland fresh water harbors nearest Kansas City and St. Louis, has aided in conserving the fresh water supply of these streams for rice irrigation, and we urge that similar work be extended to the localities throughout the nation where practicable.

It is the sense of this congress that the remaining public domain should be sacredly preserved to all the people of the United States, and should be rigidly reserved for the benefit of actual homeseekers, who will live upon the land and in good faith cultivate the soil. We recognize that much has been accomplished to this end; and under the provisions of the National Irrigation Law, 40,000,000 acres of agricultural land has been withdrawn from entry, except under that act and from the operation of laws which permit the absorption of public lands for private speculation, and the 80,000,000 acres of timberland have been withdrawn from entry in order to protect the watersheds, thereby increasing the source of water supply, and conserving the public good.

In further pursuance of this wisely established policy, of preserving the

public domain in the interest of the entire people, we urge the repeal of the Timber and Stone Act, of the Desert Land Law, and of the Commutation Clause of the Homestead Act.

As a substitute for the Timber and Stone Act, we favor the adoption of a bill passed by the upper branch of Congress at the last session, repealing the said act; and providing for the sale of stumpage and for the application of the proceeds thereof to the Reclamation Fund.

As a substitute for the Desert Land Law and the Commutation Clause of the Homestead Law, we recommend an Arid Homestead Law, which shall limit the entry of any one individual to one hundred and sixty acres, which shall permit a reasonable intervening period for reclamation before acquiring continuous residence, provided, however, that after reclamation the occupant shall be required to live on the land five years before securing title as settlers are required to do under the National Irrigation Law. We also recommend and urge the repeal of all acts permitting the selection of lieu lands, including any and all laws authorizing the issuance of any kind of land scrip, and recommend legislation for the valuation and purchase, by the Government, if necessary, of all lands in private ownership within the limits of the forest reserves.

We fully recognize that the funds now available are inadequate to the realization of the National Irrigation Policy upon a scale commensurate with the opportunities of the West, and the needs of the nation, and we favor a non-interest-bearing loan by the Government to the Reclamation Fund, to be used in the construction of projects approved by the Secretary of the Interior, and to be repaid by the owners of lands benefitted, in accordance with the provisions of the present law.

But we would not have the West depend alone upon national aid in the development of its resources, and urge the several Western states and territories to adopt legislation providing for the formation of irrigation districts,

which shall be able to raise funds by the sale of bonds, said districts to be organized only upon approval by the Secretary of the Interior, who shall employ the engineers of the Reclamation service in the construction of district irrigation works. Thus the reclamation fund will be supplemented

to the extent of millions of dollars by every state and territory, while the benefits of national administration will be vastly extended. We commend this subject to the earnest attention of the legislatures of our western states and territories.

THE RELATION OF FOREST RESERVES TO THE MINING INDUSTRY

BY

MAJOR F. A. FENN

SUPERINTENDENT OF FOREST RESERVES IN IDAHO
AND THE GALLATIN RESERVE IN MONTANA

Ever since metalliferous mining first became an important industry in the United States the Government has dealt with it in the most liberal manner. The steadfast policy has been to stimulate the prospecting of the country and encourage the development of its mineral resources. Whatever tends to retard the progress of the miner's work contravenes that policy, anything calculated to advance his interest accords with it.

Congress in the enactment of the law authorizing the setting apart of portions of the public domain as forest reserves consistently adhered to its course respecting mining when it provided in that act as follows:

"It is not the purpose or intent of these provisions, or of the act providing for such reservations, to authorize the inclusion therein of lands more valuable for mineral therein, * * * * *

than for forest purposes."

And further: "Nor shall anything herein prohibit any person from entering upon such forest reservations for all proper and lawful purposes, including that of prospecting, locating, and developing the mineral resources thereof; *Provided*, that such persons comply with the rules and regulations

covering such forest reservations."

And further still: "And any mineral lands in any forest reservation which have been or which may be shown to be such, and subject to entry under the existing mining laws of the United States and the rules and regulations applying thereto, shall continue to be subject to such location and entry, notwithstanding any provisions herein contained."

While the act contains the above quoted provisions, it also outlines a plan for the preservation of the forests within the reserves and gives to the Secretary of the Interior power to elaborate the system and make it effective (by authorizing him to "make such rules and regulations and establish such service as will insure the objects of such reservations, namely, to regulate their occupancy and use and to preserve the forests thereon from destruction.")

Realizing the vital importance of the mining industry to the national prosperity and at the same time appreciating the necessity of protecting the forests for the benefit of the people, the law-makers devised a scheme of forest protection that enables forest reserves to be maintained and the min-

ing industry to be carried on simultaneously in the same territory, not only without conflict or friction but in such manner that scientific forest methods may be applied in fullest measure while the best interests of the bona fide miner are subserved and promoted.

Strange as it may seem, after knowing the provisions of the law cited above, the establishment of a forest reserve in a mining region often excites grave apprehension in the minds of the residents of the locality. Fearing dire results from the presence of the reserve, with the administration of which they are unfamiliar and the effects of which they have not studied, mine owners are frequently aroused to strenuous opposition and seek in every way to escape from imaginary ills. What they would avoid they find in the end to be a beneficent boon.

An apt illustration is found in the history of the Black Hills Forest Reserve, one of the earliest to be set aside. The great Homestake Mine is within the limits of that reservation and when it was created the Homestake people were panic stricken. They thought the innovation would at once close their mine, and they believed its continuance would result in the practical destruction of their property. They sought to have the reserve abolished and they fought it tooth and nail. The Government was firm, however, and insisted on conferring its benefits. The experience of years has shown the Homestake owners their error. Now they appreciate the reserve system and are working hand in hand with forest officers in all that concerns the reserve. Not only so—they have adopted reserve methods in the management of their own extensive timber holdings. Now they regret that the reserve was not created before the mine was discovered.

The forest reserve system contemplates the accomplishment of a twofold object in the preservation of the forests; first, to keep them in the state of highest continued production for the benefit of the people locally de-

pendent upon them for a supply of timber products; and, second, to conserve the water supply and maintain an equable flow in the streams. These two chief purposes are admirably suited to meet the needs of the two great branches of the mining industry, lode mining and placer mining. The principal natural product required by the lode miner is timber, while the placer miner is powerless to carry on his operations without water.

Man is ever extravagant with whatever nature bestows, and miners in the use of timber, if unrestrained, demonstrate the rule. Their business makes them creatures of the present. They rarely consider the ultimate good of the community when they are cutting timber; they regard only the satisfaction of their own immediate needs in their quest for wealth. Commonly in the mountainous mineral districts there is naturally a goodly supply of timber, but the discovery of mines leads quickly to the reckless destruction of this and to the heedless impairment of the forest growth. No thought is given to the future. Wasteful, careless methods of cutting prevail and vast accumulations of tops, limbs, and other refuse soon encumber the cut-over tracts. Fires now get in and what may have escaped the ruthless hand of the chopper falls a prey to the devouring flames. Were the fire confined to the areas cut over, the damage would not be so great, but, unopposed, it sweeps on, urged by the applauding winds, and the demon of destruction works its will. Thus are destroyed quantities of timber, compared with which the amount consumed by man is insignificant. The fire is the great and real destroyer, but man, unintentionally, is, too often, responsible for the conditions which make the awful destruction possible.

Worse yet and wholly inexcusable, is the damage done by the fire-bug, who, in order to clear a brushy hillside or remove thick timber in a canyon, deliberately sets fire to the country to facilitate prospecting work. Thousands of acres of most valuable

timber have been burned in this way, to the inestimable damage of the mining industry. The anxious but unprincipled seeker for a mine lets selfishness blind him to the best interests of the community. For a temporary personal convenience he does that which may render his mine, if he find one, practically valueless, because he destroys the supply of timber upon which, very likely, hinges the question whether or not the property may be profitably worked. Such a person is unworthy the name of a prospector; he is a disgrace to the honorable class of men, among whom he intrudes himself. No penalty too severe can be imposed upon such malicious miscreants.

In the vicinity of almost every mining camp the naked hillsides testify to the fearful destruction wrought in the early days. Where formerly the mountains were covered with forests, they are now denuded. Favored spots may be seen, whereon a limited growth of seedlings and saplings proves nature's efforts to restore normal conditions, but many years must elapse ere her object can be attained, even with all the care and assistance forest reserve methods may render. In the meantime, the mines near by must, at great cost, draw upon distance sources of supply for such timber as is necessary to their continued operation.

It would appear idle to furnish examples, but an illustration is found near Virginia City, Mont., towards the head of Alder Gulch, once famous as the richest placer mining camp of the time. Producing mines are in active operation there, and development is progressing in many lode claims. But there is a shortage of forest products. Wood for fuel can not be gathered in quantities sufficient to meet the actual demand for more than a year or so longer, while timbers for underground work must be hauled long distances, and even then the material is very inferior. The stand of the scrubby timber now being utilized at great cost will be wholly inadequate unless the most rigid economy be ex-

ercised in the use of the limited supply at present available. Electricity generated by water power at remote points must supplant steam as motive power, and every device for restricting the use of timber about the mines must be resorted to or a permanent shut-down on account of lack of timber will result. And this economical use must be supplemented, too, by the most careful protection and husbanding of the young growth now struggling for a start on the cut-over and fire-swept areas. There will be a large amount of small stuff suitable for lagging and similar material on these tracts within a comparatively short time, but if cutting and culling be allowed to be done without restriction or proper supervision, what now promises to be a fairly good timber supply will be utterly destroyed before the day of its real utility arrives. Originally there was an abundance of good timber in that locality, and had forestry methods prevailed there during the forty years of the camp's existence, there would be enough yet for all legitimate needs and the miners would not be threatened with a timber famine.

The quartz-mining region around Silver City and Le Lamar in Idaho affords another case to illustrate the injurious effects of thoughtless extravagance in the use of timber in the pioneer days. Had the timber which nature placed there been economically used and care taken to prevent fires while the renewal of the forests was in progress, there would have been no shortage, but, as things are, coal must be used for fuel for domestic purposes, power for the mines is derived from the large electric plants at Swan Falls of the Snake River that cost over \$3,000,000, and timber for underground use must be transported to the mines by rail and wagon from the forested areas of central Idaho and Oregon.

Everyone familiar with placer work in any long established camp has heard the general complaint, "The climate must be changing, for water gets scarcer and scarcer every year."

Streams which formerly furnished ample water for the working of extensive properties during the full open season a few years ago are now without a sufficient flow for more than a few weeks run in the claims. The unoffending climate is held responsible for all this. We might paraphrase and say, "Oh! Climate, what sins are committed in thy name!"

The true reason for the unfortunately changed situation is not far to seek. The mountain slopes once forested, now denuded, tell the tale of repeated fires and the consequent reduced water-storing capacity of the country drained by the streams from which the placer miner's ditches used to be so well supplied.

These deplorable conditions, menacing as they are to the prosperity of every quartz and placer miner, prove the importance, aye, the absolute necessity, of preserving the forests if mining is to continue to hold its exalted place among our industrial pursuits.

Protection from fire is the great essential in forest reserve work at the present time, but there are other matters connected with the preservation of the forests almost equal in importance; timber should be economically used to avoid depleting the supply unnecessarily, and where cutting is done it should be so conducted and the refuse resulting should be so disposed of, as to do the least injury to the remaining forest growth and the leave the cut-over tract in such condition that another crop for the use of consumers yet to be shall be assured. The entire population is interested in these vital questions, but "whatever is everybody's business is nobody's business," and so long as the public generally is responsible for the protection of the forests, just so long will they be without an efficient shielding hand and left to the ravages of fires and wanton despoilers.

The proper safeguarding of the forests requires that the duty be performed by persons specially designated for the purpose. This is sought to

be accomplished through the maintenance of a corps of forest officers to whom is intrusted the execution of the law and the rules and regulations governing forest reserves. The forest reserve system in the United States was inaugurated but a few years ago; it is yet in the formative stage, but already its beneficent purposes are recognized and the wisdom of its founders is proven beyond controversy. The system in providing for the creation of forest reserves does not contemplate the locking up of the timber from the people; on the contrary, the forests in the reserves are at all times open for the satisfying of the legitimate needs of the public. Instead of withholding timber from use the true forester encourages the removal of all mature stuff and dead material not only to meet the present needs of consumers, but to make room for and stimulate the young growth and thereby assure a supply for the future.

Timber may be secured from forest reserves in two ways; by purchase, if it be wanted for corporate use or for speculative purposes, and under what is known as the "free use privilege," if it be required by an individual for his personal use. Any person may get whatever timber he requires to satisfy his personal needs free of charge. Thus the prospector or individual miner may obtain whatever he needs for the construction of his cabins, for domestic use, or for the development of his mining property, entirely without cost. But, as any other conservative yet liberal owner of timber would do under like circumstances, the Government will insist that whoever wants timber must ask for it, that he take no more than he needs, that cutting be so done that the least damage shall be inflicted on the remaining timber, and that the refuse resulting from his work be so disposed of that its agents, the forest officers, can burn the same at the proper season and reduce to a minimum the danger from the spread of fires. Certainly these requirements are so reasonable that no sane man can object to them. And then, too, the pro-

cedure is simple. Application for what is wanted is made to the nearest forest officer, who, with the applicant, goes to the locality where the timber is found and marks out what is to be cut. Permit to cut is thereupon issued by the proper authority and the applicant cuts and removes his timber and piles up ready for burning the refuse resulting from his work. For large quantities of timber wanted under the free use privilege, the Secretary of the Interior issues the permit, but for amounts where the stumpage value is \$20 or less, the supervisor of the reserve issues the permit. It must not be inferred that the fixing of a stumpage value for timber cut under the free use privilege implies any cost or expense whatever to the consumer. The applicant gets what he asks for without a cent of expense in any way or form. The valuation is merely for the convenience of forest officers in determining the value of timber taken by the people under this "free use privilege." It will thus be seen that the Government has most scrupulously guarded the interests of the individual, the prospector or other poor man, who is struggling to maintain himself. But the "free use privilege" is restricted to individuals; if timber is needed by a corporation it must be purchased. Congress in the enactment of the forest reserve law very wisely and very justly held the view that, while the individual striving to improve and develop his claim or other property is entitled to every encouragement, the aggregations of capital represented by corporations are able to pay for what they need in their enterprises. And again, too, if timber is wanted for speculative purposes, for sale to third parties, as for instance, if it is desired by a saw mill operator, it must be purchased.

In sales of timber from a forest reserve the requirement relative to cutting and disposing of refuse are similar to those in "free use" cases, but the price to be paid is determined by forest officers and depends upon the situation, condition, and character of

the timber the same as in sales made by one private person to another. Application for sale may be made by any one at any time. The amount that may be purchased is only limited by the amount available in the reserve, keeping in mind danger of impairing its capacity to subserve the great purposes for which it was established.

Foreseeing the necessity of having all undertakings within forest reserves carried on in such manner that they should not defeat the very purposes of the law, Congress gave the Secretary of the Interior power to regulate the occupancy and use of reserves. Whenever the construction of a road, a telephone line, or a ditch, or anything of the kind is desired, or if it be the wish of any one to start a store or other business establishment, the Secretary requires that proper application for the privilege be presented and proper permit therefor be granted before the thing asked for may be done. There is no cost or expense involved; all is free to the applicant. The regulation is imposed to prevent the existence in the reserves of what might be most highly detrimental to them. Without such supervisory control, the forest reserves would be only a name, their administration a laughing stock, and the law a nullity.

It is often objected that the methods prescribed relative to securing timber or obtaining a permit for a special privilege are cumbersome and involve unnecessary inconvenience and delay; in other words, that there is so much "red tape" in the forest reserve business that consumers are practically denied the benefits which Congress intended should be enjoyed under the reserve system. The objection is more specious than sound. Whenever it is the purpose to run a tunnel or sink a shaft for development, or to extend the workings of a property in extracting ore, it is known beforehand that timber will be needed for such underground work; if the construction of a mill is contemplated, the first thing to look for is suitable material; if a steam power plant is to be operated,

above all fuel must be provided. This timber question in all such matters is fundamental and should, it would seem, receive primary consideration. The prudent manager of a mine in a forest reserve would, therefore, make provision for timber at the very beginning of his preparations for any such proposed undertaking, by submitting proper application for the amount which he estimates will be required to serve his ends. And the same for any special privilege. Let the application be made for what it is expected will be wanted, at the very inception of the enterprise. An application costs nothing, neither does it bind the applicant to take what is asked for; it is merely a preparatory, often a precautionary step, and if ultimately it be found necessary to abandon the plan, if circumstances make it needless to secure the timber or to obtain the privilege, no harm has been done by the application and the negotiations initiated by it may be suspended or finally dropped. If, on the other hand, what was applied for should be really needed, the timely application prepares the way for the utilization of that which was asked for at the appointed time and place. Experience has demonstrated that the exercise of common business forethought will enable all parties in a forest reserve to get what they are legitimately entitled to receive before the time for its use is reached. There need be no delay or inconvenience on account of reserve regulations.

Miners are more prone to be careless in respect of these matters than most other people, and consequently from them come the bitterest criticisms when they are first brought in contact with the regulations. The explanation is simple. For fifty years the miners of the west have followed the suggestions of their will; they have cut and slashed the forests unrestrained; they have taken without let and destroyed without hindrance. Unfamiliar with the new order of things, they look upon the country which their energy and fortitude re-

claimed, as their own by right of discovery and exploration, and they very naturally regard any limitation of the privilege of cutting timber of doing anything else as they please, when they please, and where they please, as an infringement of an inalienable right, and they resent it accordingly. That such position, while natural under the circumstances, is a mistaken one is apparent to any right thinking person, and none is quicker to realize his error than the bona fide miner himself. When once he appreciates what the innovation is intended to accomplish, he promptly adapts his affairs to the new regime without damage or serious inconvenience to himself or his interests. The honest miner who in good faith is developing or working his property encounters no real difficulty when he confronts the forest reserve law and regulations; but it is the stake locator and the person who seeks fraudently to secure a body of timber under a pretended mining location, that meet with insuperable obstacles to the attainment of thier unworthy objects. What mine owner when looking for timber in the vicinity of his claim has not found the best and most accessible supply covered by invalid locations made by some unscrupulous grafter for no other purpose than to "hold up" the legitimate miner and compel him to purchase a worthless claim in order to secure timber to which he is lawfully entitled without money and without price. These hold-up schemes are common, but almost daily in the forest reserves they are being thwarted by the watchfulness and zeal of forest officers and timber involved in them made available for use by those actually needing it for legitimate purposes. Nothing is more detrimental to the true miner's best interests than speculative locations. At the first indication of a prospector's having made a valuable discovery, every inch of surrounding ground, every mill site in the vicinity, every foot of desirable dump ground, every acre of timber for miles around, is seized and staked off by the specu-

lator, the kid glove prospector, for the purpose of blackmailing the man whom the Government wishes to encourage, the man who by his labor and skill is honestly striving to advance the country's welfare.

While reserve officers are protecting the forests from damage by fire and from spoliation, they are at the same time vigilant to guard the Government against fraud in the legitimate location, occupancy and use of pretended claims by persons who from selfish and sinister motives attempt to evade the law relative to the acquisition of title to mineral land. The prospector or miner who in good faith is pursuing his vocation receives every assistance and encouragement from forest officers; they facilitate his operations and while doing so fight off the vampires that would bleed him to death.

Where a forest reserve is established in a mining locality, as soon as the novelty of the situation wears away and the reserve law and regulations are fairly understood, opposition on the part of the law-abiding, law-loving elements of the population ceases and amicable concert of action for the common good is established and harmoniously maintained. The rogue,

however, finds his nefarious schemes balked and he is loud in denunciation of the forest reserve system and its officers. It is aptly written:

"No thief ere felt the halter draw

With good opinion of the law."

The honest prospector and the bona fide miner have nothing to fear from a forest reserve. It is established for the advancement of their interests, together with the promotion of the general welfare. Examined comprehensively, the relation of forest reserves to the mining industry appears so intimate, the success of the one so directly interwoven with the continued prosperity of the other, that the possibility of a real antagonism between them cannot be entertained. The forest reserve system has come as a permanent benefactor of the mining industry and there is every incentive for miners to give it their loyal support. Forest officers in the administration of reserves will labor for the common good of all, and reciprocally, miners, as active and efficient friends, may co-operate in the achievement of the noble objects alike beneficial to themselves and conducive to the public weal.

FOREST MANAGEMENT IN MINNESOTA

The Pine Lands of the Chippewa Indians Being Made Remunerative to Them

The Minnesota Forest Reserve stands alone as the only forest reserve ever created by an act of Congress, not by Presidential proclamation. Executive authority is limited to those public lands which have not been otherwise appropriated. The Minnesota reserve is a part of the land formerly set aside for the Chippewa Indians, and hence was not public land subject to Presidential action. It passed a law in 1902, known as the

"Morris Bill," regulating the sale of the pine timber on the 3,000,000 acres ceded to the government by the Indians, and setting aside 225,000 acres of it as a forest reserve.

In addition, certain specified tracts and all the islands in Cass and Leech lakes were reserved as Indian lands, together with 6,400 acres more to be designated by the Bureau of Forestry and reserved absolutely from both sale and settlement. Of the 225,000 acres

200,000 must be selected from land classed as "pine land" and the remaining 25,000 acres from land classified as "agricultural land." The selection of all this was also assigned to the same bureau. The 6,400 acres chosen lie along the east and south shores of Cass Lake, and all around an arm of this lake extending southward, called Pike Bay, and four or five small lakes immediately south of it. Nature has made the locality exceedingly attractive, and reserving it from the ax and settlement will keep from destruction the wilderness beauty of these lakes, set in forests of virgin pine.

Of the 225,000 acres, the bureau has already selected 105,000, lying in a fairly compact body northeast, east, and southeast of Cass Lake. The selection of the remaining 120,000 acres awaits the completion of the Indian allotments to be made in that region, and the delineation by the War Department of the exact flowage lines for the areas that will be submerged when the water reaches the legal height behind its two dams, already constructed.

The law requires that on the 200,000 acres of pine land 95 per cent of the pine should be immediately cut, leaving 5 per cent for reforestation. Far better results would have followed had the law provided for the protection from cutting of 25 or 30 per cent, but the 5 per cent was all that could be obtained at the time the Morris bill was passed.

The law of 1889 provided for the sale of the land and the pine at the same time. The law of 1902 separated the two. The pine was to be sold, but the denuded land was to be classed as agricultural and to be opened to homestead sale and settlement, except the portion destined for a forest reserve. Great care was taken to prescribe such methods of sale as would permit the realization of the highest possible price for the timber, the proceeds from the sale of which were to go to the Indians. Briefly put, therefore, the intent of the law was to se-

cure for the Indians the full market price for the timber sold, to provide against the destruction of a forest part of which might advantageously be made permanent by leaving a small percentage of the merchantable trees, and to open to agricultural use the land suitable for this purpose.

The pine timber on the 105,000 acres already selected by the bureau has been sold, subject to the 5 per cent reservation clause. It brought a better price than did similar timber outside the reserve, sold without such restrictions. The bureau has marked on 50,000 acres left standing, and the work of marking the remainder is rapidly going forward. It is estimated that it will require three or four years to remove the timber from the lands already selected, and that it will be seven or eight years before the timber of the whole 200,000 acres is removed.

In the meantime, the bureau has performed its duty under the law carefully, and as expeditiously as possible. It located the reserve on the headwaters of the Mississippi, where it will most effectively serve its function. The location of the 6,400 acres comprising the 10 sections reserved from sale or settlement is also conceded to be the most advantageous possible. The agents of the bureau have more than half finished marking the 5 per cent of trees to be left on the first selection, and in this work will easily keep ahead of the lumbering under the sales that have been made.

With the question of what further equitable claims against the government the Indians may have, the Bureau of Forestry of course has nothing to do. Whether the large cash advance already made to the Chippewas will be considered an offset in whole or in part against the value of the lands now withdrawn from them is a question for Congress to decide. The policy followed in the past justifies the anticipation that the Chippewas will be amply remunerated for these lands and the small 5 per cent of tim-

ber on them that the government has now reserved for its own use. Already under the Morris act of 1902 they are receiving for their timber alone more than both the timber and the land would have brought them un-

der the law of 1889. This is true not only of the 225,000 acres in the reserve, but of the whole forested part of their 3,000,000 acres of ceded land. In addition, their forests are protected from damage by fire as never before.

THE SACRAMENTO VALLEY

Board of Trade Calls Attention to Immense
Agricultural Developments Possible, and Irrigation Projects that are Being Forwarded

IN the Sacramento Valley, California, great irrigation systems are being built which will add within the next few months half a million acres to the irrigated area of this country. During the past two or three years this great valley has been the scene of elaborate irrigation surveys by the United States Agricultural and Interior Departments, and the abundance of water supply and comparative cheapness of application have been commented on at length in exhaustive official reports, which have spoken in high terms of praise of the productive capabilities of Sacramento Valley soil and climate and the immense wealth certain to be created by the development of irrigation systems. It is said that the National Government has now in contemplation an immense irrigation project for the Sacramento Valley, but the people of California are not waiting on National enterprise.

At the present time three great systems are under construction in this valley. One of these, the Central Irrigation Canal, was started as a district enterprise several years ago, but like many other district irrigation projects, started under California's irrigation laws, it has been the subject of continuous litigation, and work was discontinued for years. At the present time work is being prosecuted, and it is expected that water will soon be running. This canal is 60 feet wide, and will irrigate 200,000 acres of land,

while it may be extended to water millions of acres. Its source of supply is the Sacramento River.

Another great system just nearing completion is the Yolo County Consolidated Canal, which diverts the waters of Cache Creek and will irrigate 100,000 acres of land lying in Yolo and Solano Counties. This canal is constructed by a private corporation. It is forty feet wide and carries water to a depth of six feet. A notable feature of this system is the fact that the source of Cache Creek is Clear Lake, a mountain reservoir covering eighty square miles and having vast storage possibilities. This project was seriously considered by government experts as the initial undertaking of the government under the National Irrigation Law. Water was turned into this canal October 8, and the event was marked by a great celebration at the town of Winters, near the course of the artificial stream.

Another irrigation celebration of equal importance was held a week earlier at Gridley in Butte County, and marked the breaking ground for the Butte County Canal, which will divert the waters of Feather River and cover at present an area of 215,000 acres. This system is capable of vast development, as the Feather drains an area of approximately 4,000 square miles with an annual rainfall ranging from 30 to 60 inches. This canal may be made to irrigate all the lands lying between

the Feather and the Sacramento from the point of diversion southward, an area of 700 square miles. It, too, is built by private capital.

The development of these great irrigation systems is worthy of note, both on account of the magnitude of the enterprises themselves and because of the conditions in the territory covered. The Sacramento Valley has an annual rainfall of from fifteen to thirty inches, and is far from being an arid or even semi-arid region, notwithstanding the dry summers which prevail in California. The lands that will

be watered by these canals have for half a century produced crops. Wheat, barley, vegetables, and fruits are grown. Some of the largest orchards in California are here, as well as some of the largest grain ranches in the world.

One of the first effects of the introduction of irrigation on a large scale will be to induce the subdivision of these great grain ranches into small farms and the transformation of a grain country, but sparsely inhabited, into a land of diversified crops and many homes.

RECENT PUBLICATIONS

"Boundaries of the United States and of the Several States and Territories." By Henry Gannett. Third Edition, Bulletin No. 226, Series F, U. S. Geological Survey. 45 pp., 54 plates, including maps, charts, and diagrams. Washington, Government Printing Office, 1904.

In addition to the value of such a publication as this in the way of defining geographically the boundaries of the United States, and of all States and Territories, there is an added value in the history of events which led to changes in territory. Treaties, charters, and statutes which have had bearing on boundary lines, are cited, and interesting historical changes reviewed. It is a very handy history, chronicling the territorial development of the United States, and furnishes the historical student with a classified list of treaties and charters which have led to the accession of territory. The work was first published in 1885; a second edition, much enlarged, was issued in 1900; and the demand has been such as to warrant the publication of this third edition.

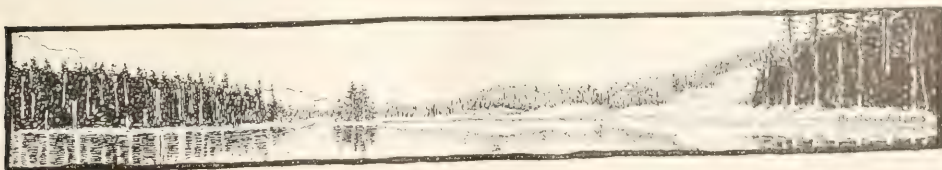
"Economic Resources of the Northern Black Hills." By J. D. Irving, with contributions by S. F. Emmons and T. A. Jagger, Jr. Professional paper No. 26, U. S. Geological Survey. 222 pp., 20 plates, including maps. Washington, Government Printing Office, 1904.

Two parts are included in this publication, a general geological review of the

region, comprising the first and introductory part, and followed by a complete review of the mining geology. The report should be of considerable value to engineers and miners, as offering an authoritative compilation of the region's mineral resources, with maps indicating the distribution of ores, and charts illustrating analyses of ore-bearing rocks, with descriptions of specified and sample regions, the whole forming a great mass of valuable data to the engineer, geologist, or expert.

"Twelfth Annual Report of the Bureau of Animal Industry for 1903." 618 pp., illustrated. Washington, Government Printing Office, 1904.

The Bureau of Animal Industry have directed an active campaign against impure meat-food, through inspection of annual food products, investigation into proper methods of raising stock, prevention of diseases of the same, methods for proper manufacture of foodstuffs allied to stock, compilation of statistics on the above subjects and their relation to similar industrial lines in foreign countries, and in the broad field of investigation, research, and administration. Their twelfth annual report is a digest of the work accomplished in the fiscal year just past, and there is a widely diversified lot of interesting articles, and a mass of data concerning its work.



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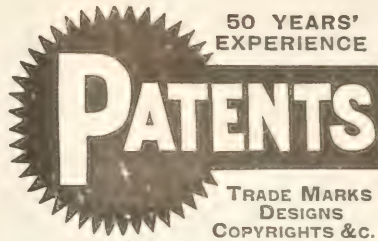
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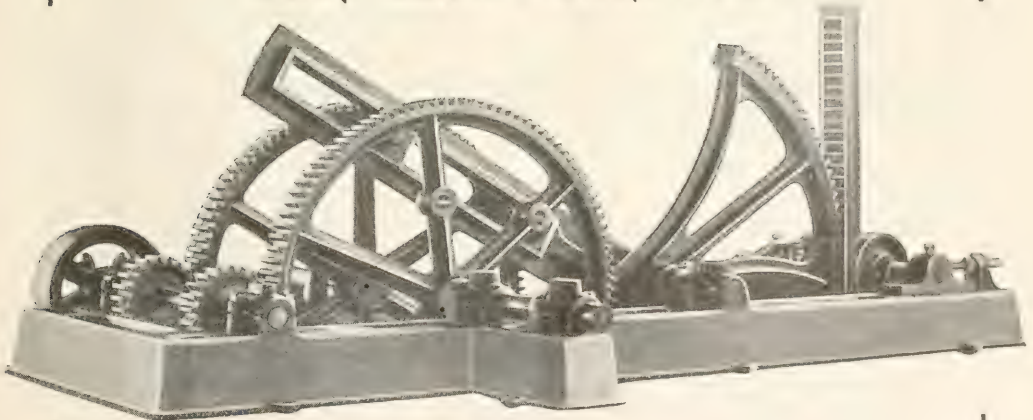
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3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.

4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.

5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.

6. The holding of an annual Irrigation Congress, and the dissemination by public meetings and through the press of information regarding irrigation, and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through irrigation and intensive farming, and the need for agricultural education and training, and the creation of rural homes as national safeguards, and the encouragement of rural settlement as a remedy for the social and political evils threatened by the congestion of population in large cities.

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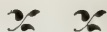
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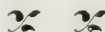
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